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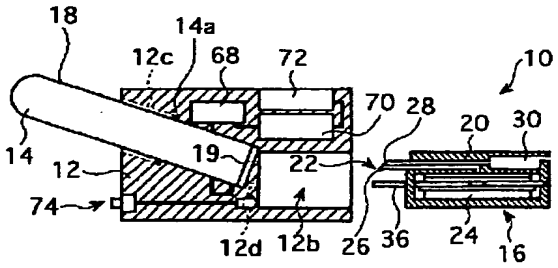
(54)【発明の名称】　簡易測定装置

(57)【要約】

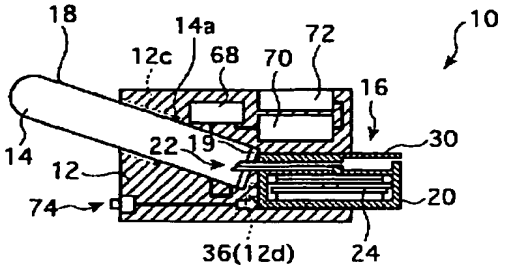
【課題】血液や尿などを試料とする免疫測定などの医療用測定等を簡単な操作で迅速に行うことができ、しかも、小型化も可能な簡易測定装置を提供する。

【解決手段】液体試料を収容する試料管と、試料管に収容された液体試料中の被測定物質量に応じた信号を出力する分析チップと、分析チップから出力された信号から、液体試料中の被測定物質量を演算し、測定結果を表示する、試料管および分析チップが着脱自在な装置本体と、試料管および分析チップが装置本体に装着された際に、液体試料が収容された試料管の内部と分析チップとを連結する連結手段とを有することにより、前記目的を達成する。

(b)



(c)



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【特許請求の範囲】
【請求項１】液体試料を収容する試料管と、
前記試料管に収容された液体試料中の被測定物質量に応じた信号を出力する分析チップと、
前記分析チップから出力された信号から、前記液体試料中の被測定物質量を演算し、測定結果を出力あるいは表示する、前記試料管および分析チップが着脱できる装置本体と、
前記試料管および分析チップが装置本体に装着された際に、前記試料管の液体試料を収容する内部と分析チップとを連通する連結手段とを有することを特徴とする簡易測定装置。
【請求項２】前記試料管が減圧採取管である請求項１に記載の簡易測定装置。
【請求項３】前記試料管が、鋭利な先端を有する部材が容易に貫通することができ、かつこの部材を抜いた際には形成された孔が閉塞される弾性体から形成される蓋体を有し、
かつ前記連結手段が、前記分析チップに固定される鋭利な先端を有するキャピラリ部である請求項１または２に記載の簡易測定装置。
【請求項４】前記分析チップが出力する信号が電気信号である請求項１～３のいずれかに記載の簡易測定装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、血液や尿等の生体から採取された試料中の被測定物質を測定する、免疫測定等の測定分野に属し、試料中の被測定物質を簡易かつ迅速に測定することができる医療用途に適した簡易測定装置に関する。
【０００２】
【従来の技術】臨床検査に必要な血液試料は、使い捨ての減圧採血管を用いて採取されることが多い。この減圧採血管は、注射筒シリンジ操作の必要がなく簡便であり、採血者の負担が少なく感染医療事故の防止にも有効である。しかし、減圧採血管内に採取された血液試料の臨床検査を行うためには採血管蓋体を外す開栓作業を要し、その作業段階の煩雑さと感染医療事故の危険性が問題点として残されている。
【０００３】そのため、開栓用具の開発が行われ、さらに、減圧採血管の蓋体を取り外すことなく、採血管内部の試料を分取できる吸引ノズルが開発された（特開平６－１８２２３４号、同６－３００６７０号の各公報参照）。また、臨床検査の自動化が進むにつれて、減圧採血管をそのまま設置できるキャップピアス方式の自動分析装置が開発された。このような自動分析装置としては、血液試料を採取した減圧採血管を保持して所定位置に移送する移送手段、血清分離手段、および採血管内の検体を吸引して血清分離手段あるいは分析手段に分注する吸引ノズルから構成される自動分析装置が知られている（特開平２－７５９５９号、同６－１２３７４１号の各公報参照）。しかしながら、これらの吸引ノズルや自動分析装置は、吸引ノズルを動作させたり、減圧採血管ホルダーを移送させたりするための駆動機構を要し、装置の小型化やコストの面で問題がある。

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【０００４】一方で、駆動機構を必要としない簡便な減圧採血管補助具もいくつか開発された。例えば、赤血球沈降速度測定用のウェスターグレン測定管の所定位置まで減圧採血管内の血液試料を導入する補助具が知られている（特開平３－１７５５７号公報参照）。また、血液試料のスライドグラス塗抹を容易にする減圧採血管の栓体が知られている（特開平６－２６５５４１号公報参照）。しかしながら、これらは減圧採血管内の試料採取法に関する技術であり、減圧採血管に採取された血液を用いて、小型でかつ簡便に血液検査、生化学検査、免疫化学検査などの各種臨床検査一般を行うことができる測定装置は、実現されていない。
【０００５】
【発明が解決しようとする課題】本発明の目的は、前記従来技術の問題点を解決することにあり、血液や尿などを試料とする免疫測定等の医療用測定を簡単な操作で迅速に行うことができ、しかも、小型化も可能な医療用途に適した簡易測定装置を提供することにある。
【０００６】
【課題を解決するための手段】前記目的を達成するために、本発明は、液体試料を収容する試料管と、前記試料管に収容された液体試料中の被測定物質量に応じた信号を出力する分析チップと、前記分析チップから出力された信号から、前記液体試料中の被測定物質量を演算し、測定結果を出力あるいは表示する、前記試料管および分析チップが着脱できる装置本体と、前記試料管および分析チップが装置本体に装着された際に、前記試料管の液体試料を収容する内部と分析チップとを連通する連結手段とを有することを特徴とする、医療用途に適した簡易測定装置を提供する。
【０００７】また、前記試料管が減圧採取管であるのが好ましい。
【０００８】また、前記試料管が、鋭利な先端を有する部材が容易に貫通することができ、かつこの部材を抜いた際には形成された孔が閉塞される弾性体から形成される蓋体を有し、かつ前記連結手段が、前記分析チップに固定される鋭利な先端を有するキャピラリ部であるのが好ましい。
【０００９】さらに、前記分析チップが出力する信号が電気信号であるのが好ましい。
【００１０】
【発明の実施の形態】以下、本発明の簡易測定装置について詳細に説明する。図１（ａ－Ｉ）に、本発明の簡易測定装置の一例の概略平面図を、図１（ａ－II）に、同II－II線概略断面図を、それぞれ示す。

【００１１】図１に示されるように、本発明の簡易測定装置１０は、基本的に、装置本体１２と、液体試料を収容する試料管１４と、試料管１４中の液体試料に存在する被測定物質（分析対象物）の量に応じた信号を出力する分析チップ１６とから構成される。また、試料管１４と分析チップ１６は、共に装置本体１２に着脱可能に構成される。

【００１２】試料管１４は、液体試料が収容される容器である。なお、本発明の簡易測定装置１０において、被測定物質すなわち分析対象物には特に限定はなく、血液検査、生化学検査、免疫化学検査等の医療用測定などの各種の測定において、液体試料を導入された分析チップが液体試料中の被測定物質量に応じた信号強度または信号特性を有する信号を発生するという分析方法が可能な物質がすべて含まれる。また、信号としては、呈色、蛍光、発光、あるいは、電流、電位、電導度、電気容量などの電気信号などが例示される。図１の図示例では、分析チップ１６が出力する信号が電気信号である場合を例示している。さらに、分析方法としては、例えば、酵素分析法などに代表される生化学反応分析法、免疫分析法に代表される特異結合分析法、および電解質イオン分析法などがある。

【００１３】酵素分析法は、被測定物質が酵素基質、補酵素、酵素補因子、酵素活性化物質、酵素阻害物質あるいは酵素自体などであり、被測定物質量に応じて酵素反応が発する信号強度あるいは信号特性が変化することを応用した分析法であり、コレステロールオキシダーゼなどを用いたコレステロール分析、リパーゼおよびグリセロキナーゼなどを用いたトリグリセリド（ＴＧ）分析、ウリカーゼなどを用いた尿酸分析、グルコースオキシダーゼなどを用いた尿糖あるいは血糖分析、蛋白分解酵素である血液凝固因子あるいはそのインヒビターの分析などが例示される。特異結合分析法は、抗原抗体反応を利用したいわゆる免疫分析法などに代表されるように、分析対象物と前記分析対象物に特異的に結合する特異結合物質との特異結合反応を利用した分析法であり、分析対象物と特異結合物質との特異結合反応に応じて信号強度あるいは信号特性が変化することを応用した分析法である。特異結合分析法で分析可能な被測定物質としては、免疫分析法で分析できる抗体、抗原としての各種蛋白質、ポリペプチド、糖蛋白質、多糖類、複合糖脂質あるいは各種ハプテンなど、核酸ハイブリダイゼーション分析法で分析できる核酸類、および、その他のリガンドレセプター結合分析法で分析できるリガンド分子、エフェクター分子、レセプター分子などが例示される。さらに具体的には、α－フェトプロテイン、癌胎児性抗原（ＣＥＡ）、ＣＡ１２５、ＣＡ１９－９等の腫瘍マーカーや、β_2 －ミクログロブリン（β_2 ｍ）、フェリチン、Ｃ反応性蛋白質（ＣＲＰ）などの各種蛋白質；　エストラジオール（E_2）、エストリオール（E_3）、ヒト絨毛性性腺刺激ホルモン（ｈＣＧ）、黄体形成ホルモン（ＬＨ）、ヒト胎盤ラクトゲン（ｈＰＬ）などの各種ホルモン；　ＨＢｓ抗原、ＨＢｓ抗体、ＨＢｅ抗原、ＨＢｅ抗体、ＨＢｃ抗体、ＨＣＶ抗体、ＨＩＶ抗体などの各種ウイルス関連抗原あるいはウイルス関連抗体；　各種アレルゲンおよびこれに特異的なＩｇＥ抗体；　麻薬性薬物、医療性薬物およびこれらの代謝産物；　ウイルスおよび疾患関連ポリヌクレオチド配列の核酸等が例示される。電解質イオン分析法は、Ｎａイオン、Ｋイオン、Ｃａイオン、無機リン、その他の金属イオンなどの電解質イオンを、比色法あるいはイオン電極法などで分析する方法である。これらの分析法は、いずれも本発明の簡易測定装置に利用できる分析法であるが、特に信号として電流、電位、電導度、電気容量などの電気信号を発生する分析法は、簡易測定装置の構成および分析手順を簡略化でき、小型でポータブルな測定装置を実現する場合に特に好適である。液体試料中の被測定物質量あるいは濃度に応じた電気信号を出力する分析法としては、後記する酵素センサ、免疫センサ、核酸センサ、微生物センサ、バイオセンサ、イオンセンサ、化学センサ、半導体センサ、ＦＥＴセンサ、ガスセンサなどとして知られている各種のセンサを用いた分析法が好適である。これらの各種センサを用いた分析法によっても、前記した各種の被測定物質を分析可能である。

【００１４】従って、液体試料としては、生体から採取可能で、被測定物質の存在が予想される液体が各種例示され、具体的には、全血、血清、血漿、尿、唾液、涙液、髄液、乳頭などからの分泌液等が例示される。なお、本発明の簡易測定装置１０を用いた測定に供される液体試料は、生体から採取した体液そのままであってもよく、生理食塩水等の希釈剤で希釈したもの、あるいは遠心操作や加熱操作などの前処理、もしくは酵素反応や増幅反応（ポリメラーゼチェイン反応など）の反応が施されたものであってもよい。また、例えば細胞や組織などの固体の試料を生体から採取して、これを緩衝液、生理食塩水、界面活性剤等を含む溶解液剤あるいは抽出剤などに溶解、あるいは懸濁あるいは抽出した液体試料であってもよい。

【００１５】前述のように、試料管１４は、このような液体試料を収容（採取）するものであって、図示例においては、試料管本体１８と蓋体１９とから構成され、測定の際には、蓋体１９を下方（図示例においては斜め下方）にして装置本体１２に装着される。

【００１６】試料管本体１８は、プラスチックやガラス等からなる、各種の医療用測定に通常に利用される容器でよい。なお、試料管本体１８の外壁には、後述する装置本体１２の溝１２ｃに挿入され、装置本体１２への試料管１４の装着位置を規定する突起１４ａが形成される。蓋体１９はゴム系樹脂、シリコンフィルム等の弾性体から形成され、後述する分析チップ１６の導入管２６

およびエア抜き管２８によって容易に穿孔され、かつ、これらを抜くと閉塞する、すなわち、いわゆる減圧採血管等に装着される蓋体と同様の物である。なお、試料管１４の構成は図示例に限定されず、前記導入管２６およびエア抜き管２８が外壁の一部を貫通して内部に挿入可能なものであれば、各種の構造および構成を有する容器が利用可能である。中でも、液体試料採取の容易性等の点で、減圧採血管等の減圧採取管が好適に利用される。また、このような汎用品と同様の構成の物を試料管１４として用いることにより、検診等における一連の臨床検査のための試料採取を同時に連続して行うことができ、検査効率の向上や被検査者の負担低減等の点で好ましい。さらに、試料管１４として減圧採血管を用いる場合には、必要に応じて、中に血液凝固阻止剤もしくは血液凝固促進剤、血球分離剤、酵素阻害剤等を入れておくのも好ましい。

【００１７】分析チップ１６は、試料管１４に収容された液体試料中の被測定物質量に応じた信号を出力するものであって、基本的に、チップ本体２０と、連結手段２２と、分析部２４とから構成される。

【００１８】図示例において、チップ本体２０には、連結手段２２および分析部２４が形成されている。連結手段２２は、導入管２６、エア抜き管２８、およびエア抜き管２８に連通する通気口３０から形成され、試料管１４中の液体試料を分析部２４に導入させる。導入管２６は、毛細管作用によって液体試料を試料管１４から分析部２４に導くキャピラリー部である。導入管２６の毛細管作用を増強するために、その内面を界面活性剤、両親媒性化合物等で処理あるいはコーティングすることも好ましい。一方、エア抜き管２８および通気口３０は、導入管２６によって試料管１４から液体試料を採取する際のエア抜きであって、毛細管作用の認められない広い間隙として通気口３０が形成されているために、液体試料はこのエア抜き管２８から通気口３０に向かう方向への流出（逆流）はできない。すなわち、エア抜き管２８は導入管２６と同様に内径０．２～１．０㎜程度に相当するキャピラリー部であり、通気口３０は内径２㎜程度以上に相当する広い間隙である。ただし、その最適なサイズは液体試料の物理的性状（粘度、含有粒子サイズ等）によって変動する。通気口３０あるいはエア抜き管２８からの液体試料の逆流を防止するために、その内面にシリコンコート等の撥水性コーティングを施してもよい。

【００１９】導入管２６およびエア抜き管２８の先端は、共にチップ本体２０から図中横方向（具体的には、後述する分析チップ１６の挿入方向と平行）に突出しており、かつ先端が鋭利な形状を有し、後述する装置本体１２の試料管挿入口１２ａに挿入保持されている試料管１４の蓋体１９を容易に穿孔、貫通できるように構成される。従って、分析チップ１６を装置本体１２のチップ挿入部１２ｃに挿入して装着すると、図２（ｂ）および図２（ｃ）に示されるように、あらかじめ装置本体１２に装着されている試料管１４の蓋体１９を、導入管２６およびエア抜き管２８の先端が穿孔、貫通し、試料管１４の内部が減圧されている場合には、エア抜き管２８あるいは導入管２６から外気が吸引されて試料管１４内部に気泡が発生し、その結果、試料管内圧は外気圧と等しくなる。次いで、毛細管作用によって導入管２６に液体試料が浸透し、キャピラリーで連通している分析部２４へと液体試料が導かれる。ここで、分析部２４は、キャピラリーあるいはろ紙などの多孔性の材質で構成された毛細管作用の強い部分であるため（流路を有するため）、導入管２６と分析部２４とが連結（接触）していることにより、液体試料は分析部２４をさらに浸透し、所定の分析部の反応が進行して液体試料中の被測定物質量に応じた信号を出力する。導入管２６および分析部２４への液体試料の浸透に伴い、入れ替わりにエア抜き管２８から外気が吸引され、試料管１４内部に気泡として入ることにより試料管１４内部圧を調整して液体試料の導入管２６および分析部２４への浸透を助ける。

【００２０】このような導入管２６およびエア抜き管２８は、注射針などの金属製の中空針あるいはプラスチック製の中空針でありチップ本体２０（あるいはそのカバー）と一体成形してもよい。好ましくは、分析チップ１６がＰＥＴ（ポリエチレンテレフタレート）フィルムなどの高分子シート積層体あるいはその打ち抜き品として形成されている場合、キャピラリー構造および／あるいは通気口を内部に構成するように高分子シート積層体を貼り合わせ、鋭利先端が残るように打ち抜いて作製すればよい。この点については、後に詳述する。

【００２１】図示例においてはエア抜き管２８および通気口３０によってエア抜きを取っているが、本発明においては、これ以外にも、試料管１４の一部を容易に破損して小孔を形成できる構成として、測定時にこれによってエア抜きを取る方法、装置本体１２に装着する際に試料管１４を圧縮して液体試料を導入管２６に押し出すことにより、エア抜きを不要とする方法等、公知の方法が各種利用可能である。但し、試料管１４の一部を破損すると、その後の液体試料の漏洩等の問題があるので、測定終了後に試料管１４を保存する場合には不適切である。また、図示例においては、連結手段２２が分析チップ１６に配置・固定される構成を有するが、本発明はこれ以外にも、装置本体１２や試料管１４に連結手段２２が配置（一部あるいは全部）される構成であってもよい。試料管１４に連結手段２２が配置・固定される場合は、例えば、試料管１４に液体試料を採取後、その蓋体１９に連結手段２２を取り付けてから装置本体１２にセットすればよい。この場合、装置本体１２に分析チップ１６を装着すると連結手段２２が試料管１４内部の液体試料と分析チップ１６の分析部２４とを連通させ、液体試料が分析部２４に導入される構成となる。また、装置

本体１２に連結手段２２が配置・固定される構成の場合には、連結手段２２が装置本体１２内にあらかじめ固定されていてもよいし、あるいは試料管１４を設置する前にディスポーサブルな連結手段２２を装置本体１２に配置・固定してもよい。しかしながら、本発明の簡易測定装置１０は、多数の試料あるいは多数の分析を連続的に処理する場合の簡便性を確保することも目的の一つであり、装置内部の清掃等の手間や流路汚染等を考慮すると装置本体１２に直接液体試料が接触するのは好ましくない。また、後述するが、試料管１４および分析チップ１６は基本的に使い捨て（ディスポーザブル）である。従って、この点および試料管１４からの液体試料の漏洩防止を考慮すると、連結手段２２は分析チップ１６に配置・固定され、試料管１４と分析チップ１６とを直接接続して分析チップ１６に液体試料を導入する構成とし、これ以外の外部には液体試料が接触しないように構成するのが好ましい。

【００２２】分析部２４は、連結手段２２によって導入された液体試料中の被測定物質量に応じた信号を出力する部分であり、図示例においては、連結手段２２の液体試料の流れ方向の下流に位置する。ここで、本発明の簡易測定装置１０においては、試料溶液中の被測定物質量に応じた信号の発生（出力）方法、すなわち、発明における被測定物質量の測定方法には特に限定はなく、公知の分析法がいずれも利用可能である。中でも特に、信号として電流、電位、電導度、電気容量などの電気信号を発生する分析法は、簡易測定装置の構成および分析手順を簡略化でき、小型でポータブルな測定装置を実現する場合に特に好適である。液体試料中の被測定物質量あるいは濃度に応じた電気信号を出力する分析法としては、酵素センサ、免疫センサ、核酸センサ、微生物センサ、バイオセンサ、イオンセンサ、化学センサ、半導体センサ、ＦＥＴセンサ、ガスセンサなどとして知られている各種のセンサを用いた測定が可能である（A.P.P.Turner, I.Karube and G.S.Wilson, Biosensors ～ Fundamentals and Applications, 1987; Electrochemical Sensors in Immunological Analysis, 1987; E.A.H.Hall, Biosensors, 1990; R.P.Buck, W.E.Hatfield, M.Umana, E.F.Bowden, Biosensor Technology～ Fundamentals and Applications）。また、これらのセンサは一般に各種の液体試料を直接分析でき、分析操作自体も簡便である。さらに、試料管１４内部の液体試料が導入管２６を通じて分析部２４へ浸透すると、後述する装置本体１２の計測部６８はこれらのセンサを通じて液体試料の到達を感知できる。そのため、測定装置自体が分析開始のタイミングを正確に検出でき、測定者が試料管１４と分析チップ１６とを測定装置に装着するだけで、液体試料中の被測定物質量に応じた精度の高い信号出力を得ることができる。

【００２３】好ましくは被測定物質が関与する特異的な反応を利用する測定方法であり、特異的な反応としては、化学反応あるいは特異結合反応を利用する測定方法が挙げられる。化学反応としては、特に特異性および反応性を高めるために酵素などの生体触媒分子や生体機能分子を利用した酵素センサ測定等が挙げられる。特異結合反応としては、機能性薄膜やキレート剤などの配位化合物に対する被測定化合物の特異的吸着反応あるいは特異的結合反応が利用できるが、特に特異性、結合力、汎用性を高めるために抗体、受容体、核酸などの生体機能分子を利用した免疫測定、核酸ハイブリダイゼーション測定、リガンドーリセプター測定等が挙げられ、特に好ましい測定方法として汎用性等の点で免疫測定法が挙げられる。被測定物質の特異的な反応を利用して、反応による被測定物質量に応じた変化を検出する方法としては、反応によって電導度変化を生じる場合には電導度を、反応によって電位差を生じる場合には電位差を、反応が電子移動を伴う電気化学的反応である場合には電流等を、それぞれ計測すればよく、分析部２４は、これらの電気信号を出力する。酵素と電子メディエータから構成される酵素電極は、被測定物質が関与する酵素反応を電極で電流として計測できる好ましい例であり、前記した文献資料中にも多数の例示がある。また、特異結合反応を利用した電流測定方法としては、本出願人による特開平５－２６４５５２号公報、特願平６－３３８６２６号、同７－１６２２９７号の各明細書等に詳述される方法が好ましく利用される。

【００２４】以下、特開平５－２６４５５２号公報などに開示される、ＭＥＤＩＡ法（Mediator Diffusion-controlled Immunoassay）として知られている電気化学的酵素免疫測定法を利用した分析部２４を一例として例示する。図３（ａ）に分析部２４の概略分解斜視図が、図３（ｂ）に分析部２４の概略側面図が、それぞれ示される。この分析部２４によれば、液体試料として血液を使用し、血中エストラジオール（Ｅ２）量を定量できるため、卵胞成熟度診断などに用いられる。

【００２５】図示例の分析部２４において、最下層には、過酸化水素および尿素の混合液を含浸させて凍結乾燥した円形セルロース濾紙が吸収部３２として設置される。吸収部３２の図中上面（以下、この面を表面、逆面を裏面とする）の中央には、円形の液体不透過性シールがシール部３２ａとして貼られている。吸収部３２の上には、円形の多孔質であるエストラジオール不溶化メンブレン３４が中心を合わせて重ねられている。

【００２６】エストラジオール不溶化メンブレン３４の上には、電極基板３６が重ねられる。電極基板３６は、ＰＥＴフィルムの表面および裏面にそれぞれ中心を一致して形成されるリング状銀電極およびリング状カーボン電極をスクリーン印刷してなるものであり、表面にリング状銀電極（対極３８）が、同裏面にリング状カーボン電極（作用極４０）が、それぞれ形成されている。さら

に、対極３８に導通して対極端子３８ａが、作用極４０に導通して作用極端子４０ａがそれぞれ形成されている。リング状電極部（３８および４０）と端子（３８ａおよび４０ａ）以外の導通部は、レジストインクで被覆されており（図示省略）表面に露出していない。また、電極基板３６は、両電極の中央を貫いている貫通孔４２を有している。なお、図１および図２に示されるように、分析チップ１６は、電極基板３６の端子側の端部が、チップ本体２０から突出するように構成される。貫通孔４２の中心をエストラジオール不溶化メンブレン３４の中心に一致させて、電極基板３６が積層される。

【００２７】電極基板３６の上には、界面活性剤処理し緩衝剤成分を含浸して凍結乾燥した円形のガラス繊維濾紙４４が、その中心が貫通孔４２の中心に合うように積層される。ガラス繊維濾紙４４の表面中央には、円形の液体不透過性シールがシール部４４ａとして貼られている。ガラス繊維濾紙４４の上には、パーオキシダーゼ酵素標識エストラジオール抗体と電子メディエータ（Ｎ，Ｎ，Ｎ′，Ｎ′－テトラキス－（２′－ヒドロキシエチル）－ｐ－フェニレンジアミン＝ＴＨＥＰＤ）との混合溶液を、円形ガラス繊維濾紙に含浸させ凍結乾燥した酵素標識抗体含浸部４６が、中心を下層と合わせて重ねられる。さらに、必要に応じて、酵素標識抗体含浸部４６の上に、円形に切断した不織布を、不純物を除去するためのフィルタ部として重ねてもよい。

【００２８】液体試料は、導入管２６によって試料管１４から酵素標識抗体含浸部４６に導入される。なお、酵素標識抗体含浸部４６の上にフィルタ部を有する場合には、液体試料はフィルタ部に導入されて、ここで凝集物等の異物を除去され、酵素標識抗体含浸部４６に導入される。酵素標識抗体含浸部４６に導入された液体試料は、酵素標識抗体含浸部４６の酵素標識抗体および電子メディエータを溶解し、シール４４ａを迂回してガラス繊維濾紙４４を中心部の方向へ流れる。この間に液体試料中のエストラジオール抗原はこの酵素標識抗体と結合反応して、抗原－酵素標識抗体複合体を形成する。また、血球成分等は、ガラス繊維濾紙４４および酵素標識抗体含浸部４６内で捕捉される。液体試料はさらに、電極基板３６の貫通孔４２を通過し、エストラジオール不溶化メンブレン３４に入り、下面にあるシール部３２ａを迂回してエストラジオール不溶化メンブレン３４内を中心から周辺部へと放射状に浸潤して吸収部３２内へ吸収され、吸収部３２内の十分量の酵素基質（過酸化水素）を溶解する。

【００２９】液体試料中の抗原エストラジオールとの複合体を形成しなかった遊離の酵素標識構体は、液体試料がエストラジオール不溶化メンブレン３４内を放射状に浸潤する際に不溶化エストラジオールと複合体（不溶化抗原－標識抗体の複合体）を形成しうる。そのため、エストラジオール不溶化メンブレン３４内には、抗原量に応じて、標識酵素の結合分布が形成されている。すなわち、液体試料中の抗原量が少なければ少ない程、標識酵素は円形のエストラジオール不溶化メンブレン３４の中心部に局在化する傾向を示す。逆に、液体試料中の抗原量が多ければ多い程、標識酵素はエストラジオール不溶化メンブレン３４全体に散らばる。

【００３０】このＭＥＤＩＡ法を利用した分析部２４においては、エストラジオール不溶化メンブレン３４の中心部に接したリング状の作用極４０とエストラジオール不溶化メンブレン３４に分布している標識酵素との間を電子メディエータが媒介して、標識酵素の酸化還元反応を電流値として計測する。前述の例では、電子メディエータであるＴＨＥＰＤが、標識酵素であるパーオキシダーゼの過酸化水素基質に対する反応と作用極４０での電極反応とを循環的に媒介し、電極反応によって作用極４０上に生じる電子メディエータの還元電流を計測する。この還元電流は、電子メディエータの拡散による物質移動に依存しているため、酵素分子と作用極４０間の距離に大きく依存する。それゆえ、検体中の抗原量が少なくてエストラジオール不溶化メンブレン３４の中心部に局在化した標識酵素分子が多いほど電流値は大きくなる。逆に、検体中の抗原量が多くてエストラジオール不溶化メンブレン３４全体に標識酵素分子が散在すると電流値は小さくなる。従って、あらかじめ標準濃度の抗原を含む液体試料の分析によって決定された抗原濃度算出式を用いて、電気信号である電流値から液体試料中の抗原濃度を演算できる。

【００３１】ここでは、分析部２４に関して電気化学的反応の利用を例示したが、検体中の被測定物質量に応じた信号を発生（出力）することのできる方法あるいは手段であれば、本発明の簡易測定装置の分析方法として利用可能であるのは前述のとおりである。

【００３２】前述のように、このような分析チップ１６は、ＰＥＴフィルムなどの高分子シート積層体、あるいはその打ち抜き品として形成することができる。前述したＭＥＤＩＡ法免疫分析チップに基いて、図４に、その一例を示す。

【００３３】図４に示される分析チップ１６Ａは、基本的に、前記分析部２４に加え、四角系でほぼ同形状を有する７枚のシート（板状材）を積層することにより、前述の分析チップ１６と同機能を有する分析チップを形成したものである。図４に示されるように、分析チップ１６Ａの最下層には四角形の基板４８が配置され、その上には、基板４８と同形で中央部に吸収部３２等と同形状の貫通孔５０ａが形成された第１保持部材５０が積層される。分析部２４の吸収部３２およびエストラジオール不溶化メンブレン３４は、貫通孔５０ａに挿入されて保持される。この第１保持部材５０の上には、前述の電極基板３６が積層され、その上には、前記第１保持部材５０と同様の形状を有する第２保持部材５２が積層され

る。前述のガラス繊維濾紙４４および酵素標識抗体含浸部４６は、第２保持部材５２の貫通孔５２ａに挿入され、前述の分析部２４が構成される。

【００３４】第２保持部材５２の上には、基板４８とほぼ同形で、かつ図中左方（分析チップ挿入方向）にテーパ状の鋭利な先端を有する凸部５４ｂが形成された第１板状部材５４が積層される。また、この第１板状部材５４には、その中心に酵素標識抗体含浸部４６と連通するための貫通孔５４ａが形成される。第１板状部材５４の上には、これと同様の外観形状を有する導入板５６が積層され、この導入板５６の上には、貫通孔５４ａを有さない以外は第１板状部材５４と同形状の第２板状部材５８が積層される。導入板５６には、導入板５６を上下に貫通して凸部５６ｂの先端から第１板状部材５４の貫通孔５４ａに対応する位置まで延在する導入溝５６ｃが形成されている。すなわち、図示例の分析チップ１６Ａにおいては、導入板５６を上下の板状部材で挟むことにより、キャピラリ状の導入管２６を形成しており、液体試料は導入溝５６ｃを流れて貫通孔５４ａから分析部２４（酵素標識抗体含浸部４６）に導入される。

【００３５】第２板状部材５８の上には、これと同様の外観形状のエア抜き板６０が積層され、エア抜き板６０の上には、中央に四角形の打抜部６２ａを有する以外は第２板状部材５８と同様の第３板状部材６２が積層される。さらに、第３板状部材６２の上には、若干の厚みがあり打ち抜き部６２ａと同形状の空間６４ａを有するスペーサ６４が積層され、その上すなわち分析チップ１６Ａの最上層には、基板４８と同形状の上部カバー６６が積層され、分析チップ１６Ａが形成される。このエア抜き板６０には、エア抜き板６０を上下に貫通して凸部６０ｂの先端から前記空間６４ａ（打抜部６２ａ）に対応する位置まで延在するエア抜き溝６０ｃが形成され、さらに、右方端部には、空間６４ａに対応する位置から外部に開放する溝６０ｄがエア抜き板６０を上下に貫通して形成される。すなわち、図示例の分析チップ１６Ａでは、空間６４ａに至る溝６０ｂを有するエア抜き板６０を第２板状部材５８および第３板状部材６２で挟持することによりエア抜き管２８を形成し、さらに、空間６４ａを有するスペーサ６４ならびに打抜部６２ａを有する第３板状部材６２を、エア抜き板６０および上部カバー６６で挟持することにより、通気口３０を形成し、溝６０ｄによって外部に開放する。

【００３６】このような分析チップ１６Ａを形成する板状材の材料には特に限定はなく、剛性を十分に確保、特に導入管２６やエア抜き管２８を形成する凸部が試料管１４の蓋体１９を容易に穿孔できる剛性が確保でき、測定に影響を与えることがない材料が各種利用可能であるが、例えば、前述のＰＥＴ等の各種の樹脂材料、ステンレス等の金属材料等が例示される。

【００３７】このような試料管１４および分析チップ１６は、共に装置本体１２に装着可能にされる。図示例において、装置本体１２の側面（図１中左側）には試料管１４を装着するための前述の試料管挿入口１２ａが形成され、その対面には、分析チップ１６を装着するためチップ挿入部１２ｂが形成される。さらに、この装置本体１２には、分析チップ１６から出力された電気信号を計測・処理する計測部６８、計測部６８からの出力信号を演算して測定結果とする演算部７０、測定結果を表示する表示パネル７２、および装置本体１２に装着された分析チップ１６を排出するためのイジェクト機構７４が配置される。

【００３８】試料管挿入口１２ａは、試料管１４とほぼ同じ直径を有し、装置本体１２の図中左側面上方から斜め下方に向かってチップ挿入部１２ｂに至る円柱状の貫通孔であり、前述のように、試料管１４は、この試料管挿入口１２ａから挿入・取り外しされることにより、装置本体１２に着脱可能にされる。また、試料管１４の外周面には突起１４ａが形成され、試料管挿入口１２ａの内壁面にはこれに対応する溝１２ｃが形成されており、試料管１４を挿入した際に、溝１２ｃの試料管１４挿入方向端部と突起１４ａとが当接することにより、試料管１４の挿入が規制され、所定の挿入位置に保持、固定される。なお、本発明においては、必要に応じて、試料管１４と、試料管挿入口１２ａとに、互いに係合するリブと凹溝とを形成し、あるいは、試料管１４と、試料管挿入口１２ａとを互いに緩く嵌合するサイズ（径）とすることにより、試料管１４が装置本体１２に装着された際に、試料管１４を確実に保持できる構成としてもよい。

【００３９】一方、チップ挿入部１２ｂは、分析チップ１６が挿入可能な開口で、図２に示されるように、連結部２２が試料管１４内に挿入可能な位置に分析チップ１６を収容し、これを保持する。なお、必要に応じて、チップ挿入部１２ｂと分析チップ１６とに互いに係合する突起（図１中符号ｙ）と凹部（図１中符号ｘ）とを形成する方法等の公知の方法によって、装置本体１２への分析チップ１６の装着をより確実なものとしてもよい。また、突起ｙは、他の部材の押圧によりチップ挿入部１２ｂ壁内に収納可能に構成してもよい。ここで、チップ挿入部１２ｂの分析チップ１６挿入方向の終端には、電極基板３６の分析チップ１６から突出する部分が挿入される溝１２ｄが形成される。すなわち、分析チップ１６の対極端子３８ａおよび作用極端子４０ａは、この溝１２ｄに挿入され、それぞれ、公知の手段で計測部６８に電気的に接続される。

【００４０】図示例の装置は、好ましい態様として、装置本体１２（チップ挿入部１２ｂ）に装着された分析チップ１６を排出するためのイジェクト機構７４を有する。イジェクト機構７４には特に限定はなく、カム機構やリンク機構などを用いた機械的な押動手段等、公知のものが全て利用可能である。また、装置本体１２に装着

された分析チップ１６を、スプリング等で排出方向に付勢し、これをフック等で押さえて（ロックして）分析チップ１６を装置本体１２に装着する構成とし、このフック等によるロックを解除することにより、分析チップ１６を排出する構成としてもよい。

【００４１】前述のように、分析チップ１６の電極基板３６の端子部が溝１２ｄに挿入されることにより、対極端子３８ａおよび作用極端子４０ａが計測部６８に電気的に接続される。計測部６８はこの電極基板端子部の溝１２ｄへの挿入を検知して、測定可能状態となる。計測部６８は、必要に応じて対極端子３８ａと作用局端子７４ａとの間に電位を印加し、さらに分析チップ１６（対極端子３８ａおよび作用極端子４０ａ）から出力された電気信号を計測し、Ａ／Ｄ変換等の必要な処理を行って、演算部７０に出力する。演算部７０では、タイマーあるいはカウンタを有しており、液体試料の作用極４０への到達を検知してから所定時間後に計測部６８からの出力信号を演算して、測定結果とし、この測定結果は、表示パネル７２に表示される。なお、本発明の簡易測定装置１０において、表示パネル７２に表示される測定結果は、測定値をそのまま表示するものであってもよく、陽性もしくは陰性、正常もしくは異常等の簡単なメッセージを表示するものであってもよく、あるいはその両者を表示するものであってもよい。さらに、これらのメッセージとしては、国際公開番号ＷＯ９５／１６９７０号明細書に示されるような、測定者に指示を与えるメッセージあるいはコマンドであってもよい。また、表示パネル７２としては、液晶表示、ＬＥＤを用いた表示等、公知のディスプレイが全て利用可能である。

【００４２】本発明にかかる簡易測定装置１０は、基本的にこのような構成を有するものであるが、以下、その作用について説明する。図示例の簡易測定装置１０においては、まず、図１～図２（ｂ）に示されるように、試験管挿入口１２ａに試料管１４を挿入し、装置本体１２に試料管１４を装着する。この時、試料管１４が水平面から少し角度を持って装着されるように、試験管挿入口１２ａには前述のように傾斜が付けられている。これにより、試料管１４内の液体試料を無駄なく分析できる。次いで、図２（ｃ）に示されるように、装置本体１２のチップ挿入部１２ｂに分析チップ１６を挿入し、装着する。これにより、連結手段２２（導入管２６およびエア抜き管２８）が試料管１４の蓋体１９を貫通して内部に到り、導入管２６から液体試料が分析部２４に流入する。同時に、分析チップ１６の対極端子３８ａおよび作用極端子４０ａが溝１２ｄに挿入され、計測部６８に電気的に接続される。液体試料が分析部２４に流入すると、先に図３を参照して説明したように、液体試料中の被測定物質量に応じた電気信号が対極端子３８ａおよび作用極端子４０ａから計測部６８に出力され、計測結果が演算部７０に出力されて測定結果が演算され、表示パネル７２に出力される。このようにして測定が終了したら、イジェクト機構７４によって分析チップ１６を装置本体１２から排出し、試料管１４を装置本体１２から引き抜いて取り外す。試料管１４は、別の検査に供され、あるいは廃棄される。他方、分析チップ１６は廃棄される。なお、同一の試料に対して連続して別の分析を行う場合には、試料管１４を装置本体１２に装着したまま、次ぎの測定に対応する分析チップを装着して測定を行えばよい。

【００４３】本発明の簡易測定装置は、以上説明した構成例以外にも、各種の構成が可能である。以下にその一例を例示する。なお、以下に示される例は、試料管１４や分析チップ１６の装着方法や、各部材の配置位置等が異なる以外は、基本的に前述の簡易測定装置１０と同様の構成を有するので、同じ部材には同じ符号を付し、以下の説明は異なる部分を主に行う。

【００４４】図５および図６に示される簡易測定装置７６は、装置本体７８の上方から試料管１４を装着する構成を有するものであって、従って、円柱状の試料管挿入口７８ａが装置本体７８の上面を貫通して形成されている。また、分析チップ８０のチップ本体８２の上部中心にも、試料管挿入口７８ａに対応する保持孔８０ａが形成され、連結手段２２はこの保持孔８０ａの中心で上方に向かって突出して形成されている。

【００４５】この簡易測定装置７６においては、先ず、図５～図６（ｂ）に示されるように、分析チップ８０を装置本体７８のチップ挿入部７８ａに装着する。また、これにより、分析チップ８０の電極基板６０がチップ挿入部７８ａの溝７８ｄに挿入され、両者が電気的に接続される。次いで、図６（ｂ）～（ｃ）に示されるように、試料管１４を蓋体１９を下方にして、試料管挿入口７８ａから保持孔８０ａに挿入して装着し、これにより、連結手段２２が試料管１４内に挿入され、先と同様にして測定が行われる。

【００４６】他方、図７および図８に示される簡易測定装置８４は、装置本体８６をヒンジ状に開閉可能に構成したものである。この構成を有する簡易測定装置８４においては、先ず図７（ａ）～（ｂ）に示されるように、装置本体８６の試料管挿入口８６ａに試料管１４を固定する。ここで、この態様においては、試料管１４は比較的強固に試料管挿入口８６ａに保持される。次いで、図７（ｂ）～図８（ｃ）に示されるように、分析チップ８８の保護キャップ９０を取り外し、装置本体８６を開放して、分析チップ８８をチップ挿入部８６ｃに収納し、次いで、図８（ｄ）に示されるように、装置本体８６を閉塞する。これにより、連結手段２２が試料管１４内に挿入され、先と同様にして測定が行われる。なお、分析チップ８８を上方から装着する本例においては、電極基板６０は分析チップ８８から突出せず、対極端子３８ａおよび作用極端子４０ａは分析チップ８８の側面に露出

する構成となっており、挿入部８６ｂの内側面に配置される端子と両端子とが電気的に接触することにより、計測部６８と対極端子３８ａおよび作用極端子４０ａとが電気的に接続される。

【００４７】以上説明した本発明にかかる簡易測定装置は、分析チップへの液体試料の流入を毛細管現象によって行っているが、本発明はこの構成に限定されず、ポンプなどを利用した吸引や押出等の手段や、重力等を利用して分析チップへの液体試料の流入を行ってもよい。

【００４８】以上の例では、分析部２４に関して電気化学的反応の利用を例示したが、検体中の被測定物質量に応じた信号を発生（出力）することのできる方法あるいは手段であれば、本発明の簡易測定装置の分析方法として利用可能であるのは前述のとおりである。信号が呈色、蛍光、発光などの場合には、装置本体１２の計測部６８は光電増倍管、フォトダイオード、発光ダイオード、半導体レーザなどから構成される公知の色差計、光度計が使用される。

【００４９】以上、本発明の簡易測定装置について説明したが、本発明はこれに限定はされず、本発明の要旨を逸脱しない範囲において、各種の改良および変更を行ってもよいのはもちろんである。

【００５０】例えば、前述の簡易測定装置を複数検体の同時測定が可能な装置に拡張あるいは改良することも容易にできる。複数検体用の簡易測定装置では、前述の簡易測定装置と同様の構成を有する試料挿入口とそれに対応するチップ挿入部を複数備えており、それぞれ、独立してあるいは連動して分析が行える。このような複数検体同時測定用装置では、計測部、演算部あるいは表示パネルなどを統合することにより測定装置の構成を簡略化しても良いし、複数の試料挿入口とそれに対応するチップ挿入部をカルーセル上に円形に配置して操作性などを向上させてもよい。あるいは、前述の単数検体用の測定装置を外部コンピュータから複数制御可能に構成してもよい。この場合には、コンピュータの処理能力が許す限り、測定者は測定状況や測定規模に応じて自在に測定装置を拡張接続し測定結果をコンピュータに取り込んでデータ処理ができるため効率よい臨床検査業務が可能となる。いずれにしても、単数検体用の測定装置の例で述べたように、分析チップおよび試料管を測定装置に装着した時に自動的に液体試料が分析部に導入され、その液体試料の導入を自動的に検出して測定が開始され、自動的に測定結果が演算処理されるため、複数検体用の場合でも非常に独立性の高い測定システムとなる。すなわち、測定すべき検体が発生した時に、測定装置上の空いている試料管挿入口に試料管を装着し、測定すべき項目に対応した分析チップを装着すれば、自動的に測定結果が得られる。従って、本発明の簡易測定装置は、試料管から反応容器へ液体試料を分注し、反応容器を試薬液分注工程、インキュベーション工程、洗浄工程、測定工程などから成る反応ラインおよび移送手段で処理して測定するタイプの従来の全自動分析装置などで複雑な処理あるいは手続きを要した複数検体多項目ランダムアクセス機能や割り込み測定を、極めて簡単な小型の装置として提供できる。

【００５１】

【発明の効果】以上、詳細に説明したように、上記構成を有する本発明の簡易測定装置によれば、分析チップと試料管とを装置本体に装着するだけの簡易な操作で測定を行うことができ、しかも、分析チップは基本的に使い捨てであるのでメンテナンス等をほとんど不要とでき、血液や尿などを試料とする免疫測定等の医療用測定を、簡単な操作で迅速に行うことができる。

【図面の簡単な説明】

【図１】（ａ－Ｉ）は本発明の簡易測定装置の一例の概略平面図、（ａ－II）は同II－II線概略断面図である。

【図２】（ｂ）および（ｃ）は、図１に示される簡易測定装置の操作を説明するための概略断面図である。

【図３】（ａ）は図１に示される簡易測定装置の分析部の概略分解斜視図、（ｂ）は同分析部の側面図である。

【図４】図１に示される簡易測定装置に用いられる分析チップの別の例の概略分解斜視図である。

【図５】（ａ－Ｉ）は本発明の簡易測定装置の別の例の概略平面図、（ａ－II）は同II－II線概略断面図である。

【図６】（ｂ）および（ｃ）は、図５に示される簡易測定装置の操作を説明するための概略断面図である。

【図７】（ａ）および（ｂ）は、本発明の簡易測定装置の別の例を示す概略断面図である。

【図８】（ｃ）および（ｄ）は、図７に示される簡易測定装置のの操作を説明するための概略断面図である。

【符号の説明】

１０，７６，８４　簡易測定装置
１２，７８，８６　装置本体
１２ａ，７８ａ，８６ａ　試料管挿入口
１２ｂ，７８ｂ，８６ｂ　チップ挿入部
１４　試料管
１６，８０，８８　分析チップ
１８　試料管本体
１９　蓋体
２０，８２　チップ本体
２２　連結手段
２４　分析部
２６　導入管
２８　エア抜き管
３０　通気孔
３２　吸収部
３４　エストラジオール不溶化メンブレン
３６　電極基板
３８　対極

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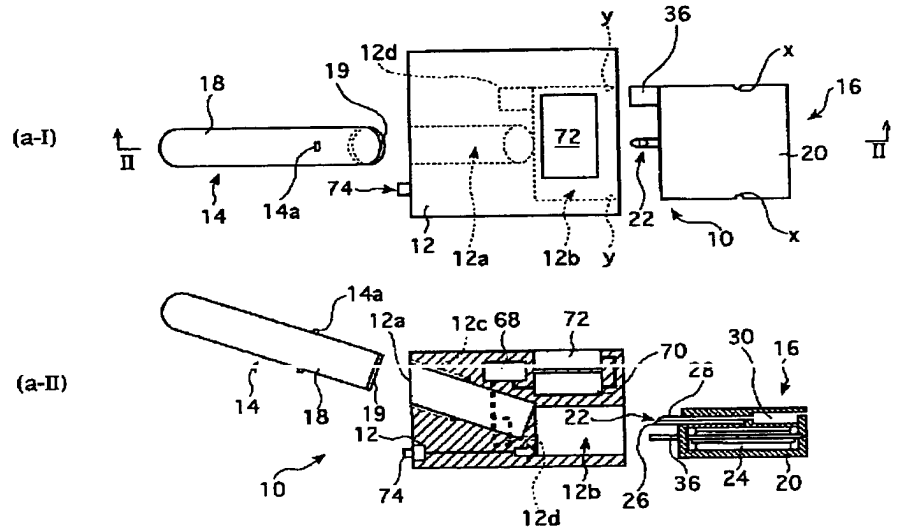
４０　作用極
４２　貫通孔
４４　ガラス繊維濾紙
４６　酵素標識含浸部
４８　基板
５０　第１保持部材
５２　第２保持部材
５４　第１板状部材
５６　導入板

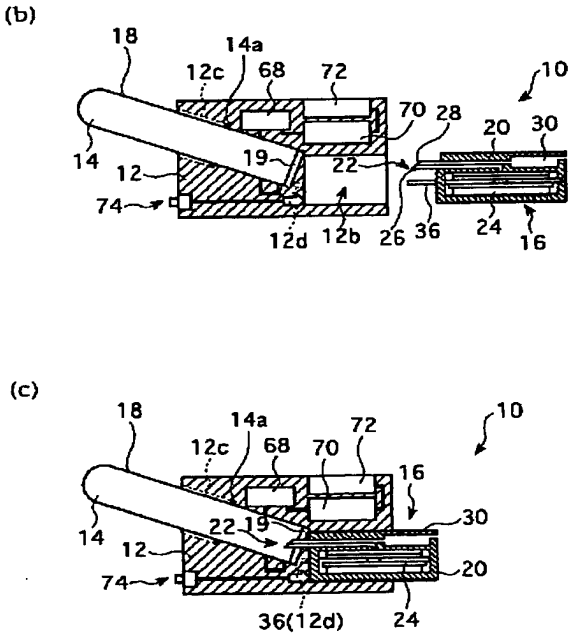
18

５８　第２板状部材
６０　エア抜き板
６２　第３板状部材
６４　スペーサ
６６　上部カバー
６８　計測部
７０　演算部
７２　表示パネル
７４　イジェクト機構

【図１】



【図２】



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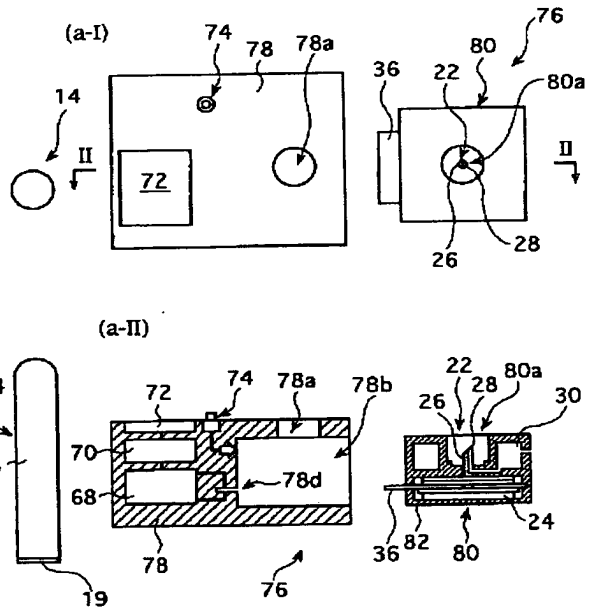

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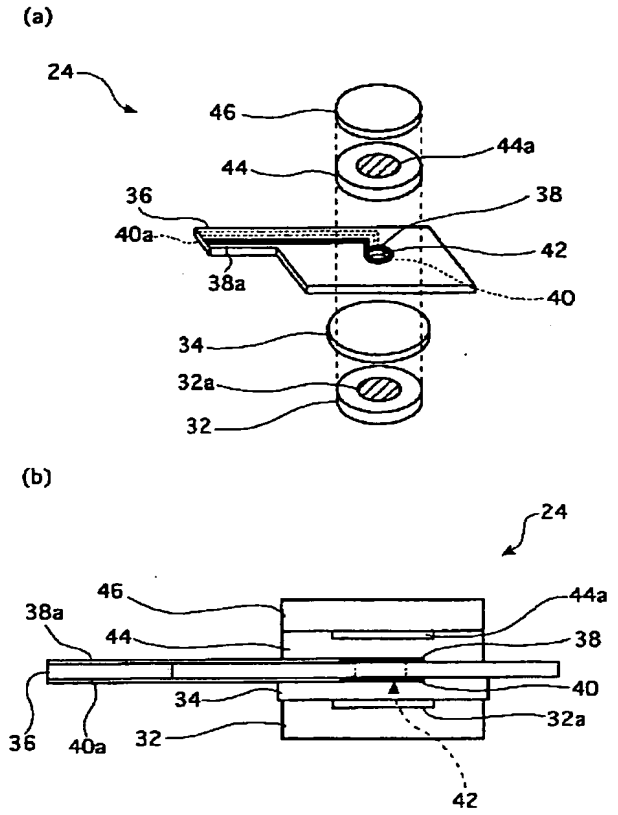
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34
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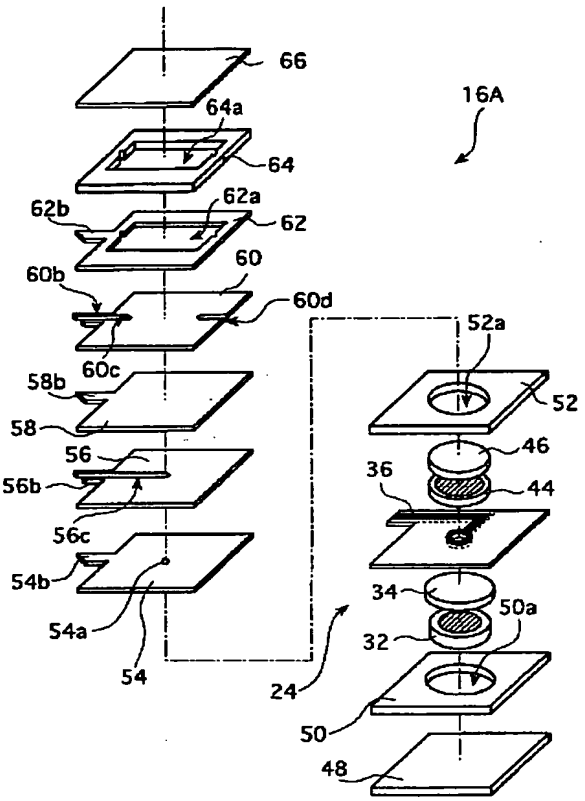
36
40a
32
32a
42

【図４】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50
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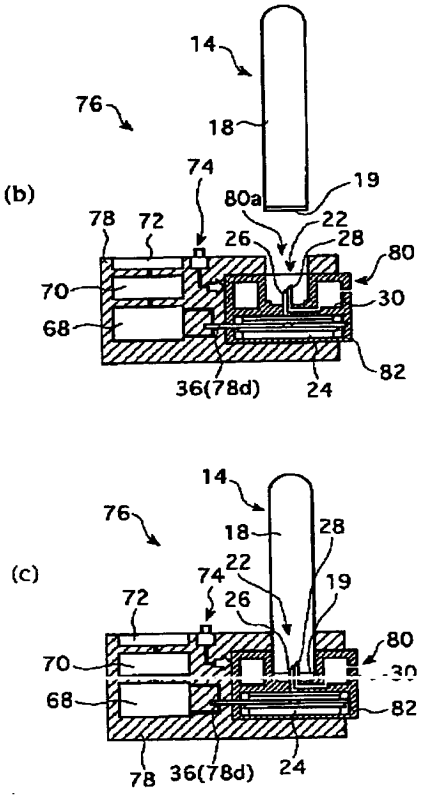
【図６】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(c)
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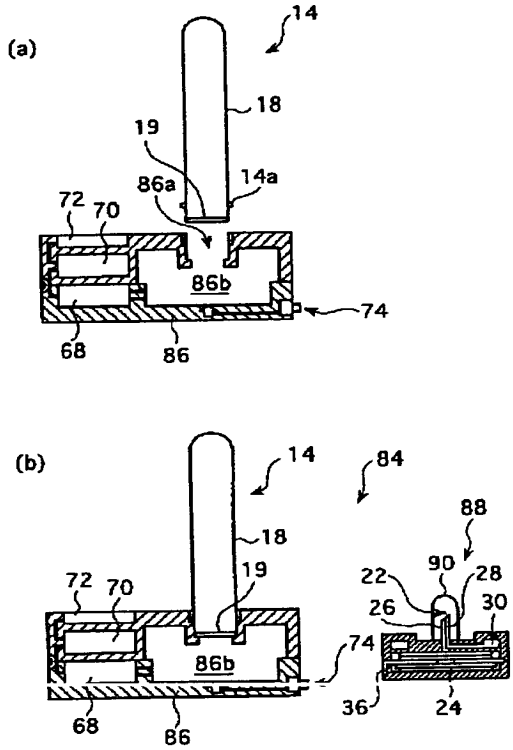
【図７】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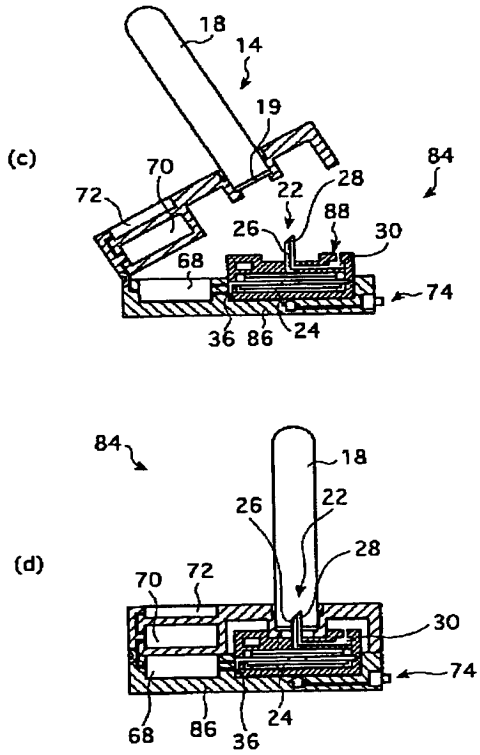
24

【図８】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(d)
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72
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74
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36
24

PATENT ABSTRACTS OF JAPAN

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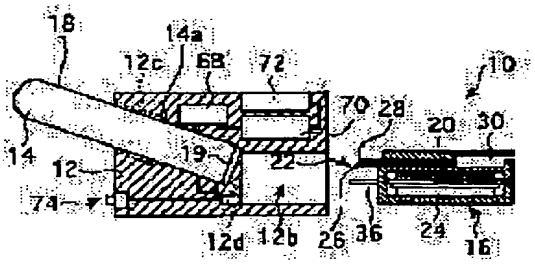
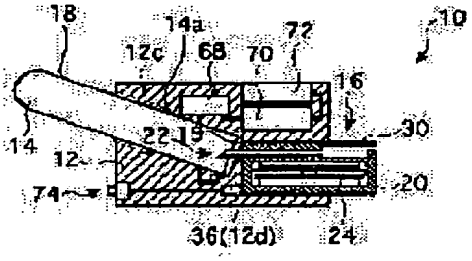
(72)Inventor : YAMAUCHI CHUICHI

(54) SIMPLIFIED MEASURING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a simplified measuring device capable of quickly taking medical measurement such as immunity measurement using blood or urine as a sample and capable of being miniaturized.
SOLUTION: This simplified measuring device is provided with a sample tube 14 storing a liquid sample, an analytical chip 16 outputting the signal corresponding to the measured object mass in the liquid sample stored in the sample tube 14, a device main body 12 calculating the measured object mass in the liquid sample based on the signal outputted from the analytical chip 16, displaying the measured result, and removably fitted with the sample tube 14 and the analytical chip 16, and a connecting means 22 connecting the analytical chip 16 and the inside of the sample tube 14 storing the liquid sample when the sample tube 14 and the analytical ship 16 are fitted to the device main body 12.





LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] Sample tubing which holds a liquid sample, and the analysis chip which outputs the signal according to the device-under-test mass in the liquid sample held in said sample tubing, The body of equipment which can detach and attach said sample tubing and the analysis chip which calculate the device-under-test mass in said liquid sample, and output or display a measurement result from the signal outputted from said analysis chip, The simple measuring device characterized by having a connection means to open for free passage the interior in which the liquid sample of said sample tubing is held, and an analysis chip when the body of equipment is equipped with said sample tubing and an analysis chip.
[Claim 2] The simple measuring device according to claim 1 said whose sample tubing is reduced pressure extraction tubing.
[Claim 3] The simple measuring device according to claim 1 or 2 which is the capillary section in which it has the lid formed from the elastic body with which the formed hole is blockaded when the member in which said sample tubing has a sharp tip can penetrate easily and extracts the member of a parenthesis, and said connection means has the sharp tip fixed to said analysis chip.
[Claim 4] The simple measuring device according to claim 1 to 3 whose signal which said analysis chip outputs is an electrical signal.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention belongs to the measurement fields which measure the quality of a device under test in the sample extracted from living bodies, such as blood and urine, such as immunoassay, and relates to the simple measuring device suitable for the medical-application way which can measure simply and quickly the quality of a device under test in a sample.
[0002]
[Description of the Prior Art] A blood sample required for a clinical laboratory test is extracted using disposable reduced pressure blood collecting tubing in many cases. There is no need for glass syringe syringe actuation, this reduced pressure blood collecting tubing is simple, and its burden of a blood collecting person is effective also in prevention of an infection medical accident few. However, in order to conduct the clinical laboratory test of the blood sample extracted in reduced pressure blood collecting tubing, the unstopping activity which removes a blood collecting tubing lid is required, and the complicatedness of the activity phase and the danger of an infection medical accident are left behind as a trouble.
[0003] Therefore, development of unstopping tools was performed, and the suction nozzle which can isolate the sample inside blood collecting tubing preparatively was developed further, without removing the lid of reduced pressure blood collecting tubing (refer to each official report of JP,6-182234,A and 6-300670). Moreover, the automatic analyzer of the cap pierced earring method which can install reduced pressure blood collecting tubing as it is was developed as automation of a clinical laboratory test progressed. The automatic analyzer which consists of a migration means to hold reduced pressure blood collecting tubing which extracted the blood sample as such an automatic analyzer, and to transport to a predetermined location, a blood serum separation means, and a suction nozzle that attracts the specimen in blood collecting tubing and is poured distributively for a blood serum separation means or an analysis means is known (refer to each official report of JP,2-75959,A and 6-123741). However, these suction nozzles and automatic analyzers operate a suction nozzle, or require the drive for making a reduced pressure blood collecting tubing electrode holder transport, and have a problem in respect of the miniaturization of equipment, or cost.
[0004] On the other hand, some simple reduced pressure blood collecting tubing auxiliary implements which do not need a drive were also developed. For example, the auxiliary implement which introduces the blood sample in reduced pressure blood collecting tubing to the predetermined location of WESUTA grain measurement tubing for erythrocyte sedimentation rate measurement is known (refer to JP,3-17557,A). Moreover, the plug of reduced pressure blood collecting tubing which makes the slide glass smear of a blood sample easy is known (refer to JP,6-265541,A). However, these are the techniques about the sampling method in reduced pressure blood collecting tubing, and the measuring device which can conduct various general clinical laboratory tests, such as a blood test, biochemical inspection, and immunochemistry inspection, simple small is not realized using the blood extracted by reduced pressure blood collecting tubing.
[0005]
[Problem(s) to be Solved by the Invention] The purpose of this invention is to solve the trouble of said conventional technique, it can perform quickly medical-application measurement of the immunoassay which makes blood, urine, etc. a sample by easy actuation, and, moreover, offering the simple measuring device suitable for a possible medical-application way also has a miniaturization.
[0006]
[Means for Solving the Problem] Sample tubing with which this invention holds a liquid sample in order to attain said purpose, The analysis chip which outputs the signal according to the device-under-test mass in the liquid sample held in said sample tubing, The body of equipment which can detach and attach said

sample tubing and the analysis chip which calculate the device-under-test mass in said liquid sample, and output or display a measurement result from the signal outputted from said analysis chip, When the body of equipment is equipped with said sample tubing and an analysis chip, the simple measuring device suitable for the medical-application way characterized by having a connection means to open for free passage the interior in which the liquid sample of said sample tubing is held, and an analysis chip is offered.
[0007] Moreover, it is desirable that said sample tubing is reduced pressure extraction tubing.
[0008] Moreover, it is desirable that it is the capillary section in which it has the lid formed from the elastic body with which the formed hole is blockaded when the member in which said sample tubing has a sharp tip can penetrate easily and extracts the member of a parenthesis, and said connection means has the sharp tip fixed to said analysis chip.
[0009] Furthermore, it is desirable that the signal which said analysis chip outputs is an electrical signal.
[0010]
[Embodiment of the Invention] Hereafter, the simple measuring device of this invention is explained to a detail. The outline top view of an example of the simple measuring device of this invention is shown in drawing 1 (a-I), and this II-II line outline sectional view is shown in drawing 1 (a-II), respectively.
[0011] As shown in drawing 1 , the simple measuring device 10 of this invention consists of analysis chips 16 which output the signal according to the amount of the quality of a device under test (analysis object) which exists in the liquid sample in the body 12 of equipment, the sample tubing 14 which holds a liquid sample, and the sample tubing 14 fundamentally. Moreover, the sample tubing 14 and the analysis chip 16 are constituted removable by both the bodies 12 of equipment.
[0012] The sample tubing 14 is a container with which a liquid sample is held. In addition, in the simple measuring device 10 of this invention, there is especially no limitation in the quality of a device under test, i.e., an analysis object, and all the matter in which the analytical method that the analysis chip introduced in the liquid sample generates the signal which has the signal strength or the signal property according to device-under-test mass in a liquid sample is possible is contained in it in various kinds of measurement, such as medical-application measurement of a blood test, biochemical inspection, immunochemistry inspection, etc. Moreover, as a signal, electrical signals, such as coloration, fluorescence, luminescence or a current, potential, electric conductivity, and electric capacity, etc. are illustrated. In the example of illustration of drawing 1 , the case where the signal which the analysis chip 16 outputs is an electrical signal is illustrated. Furthermore, as analytical method, there are a biochemical reaction analysis method represented by the enzyme analysis method etc., a unique joint analysis method represented by the immunity analysis method, an electrolyte ion analysis method, etc., for example.
[0013] The quality of a device under test an enzyme analysis method An enzyme substrate, a coenzyme, enzyme cofactor, the quality of an enzyme activity ghost, It is enzyme inhibitor or the enzyme itself, and is an analysis method adapting the signal strength or the signal property which an enzyme reaction emits according to device-under-test mass changing. The triglyceride (TG) analysis using cholesterol analysis, lipase, a glycerokinase, etc. using cholesterol oxidase etc., Analysis of the blood coagulation factor which is the urine sugar using uric-acid analysis, glucose oxidase, etc. using uricase etc. or blood sugar analysis, and a proteolytic enzyme, or its inhibitor etc. is illustrated. As represented by the so-called immunity analysis method using an antigen-antibody reaction etc., a unique joint analysis method is an analysis method using a unique ligation reaction with the unique cementing material specifically combined with an analysis object and said analysis object, and is an analysis method adapting signal strength or a signal property changing according to the unique ligation reaction of an analysis object and a unique cementing material. The nucleic acids which can be analyzed with nucleic-acid hybridization analysis methods, such as the various protein, a polypeptide, glycoprotein, polysaccharide, a compound glycolipid, or various haptens as the antibody which can be analyzed with an immunity analysis method, and an antigen, as quality of a device under test which can be analyzed with a unique joint analysis method and the ligand molecule which can be analyzed with other ligand receptor joint analysis methods, an effector molecule, a receptor molecule, etc. are illustrated. Still more specifically Alpha fetoprotein, a carcinoembryonic antigen (CEA), The tumor marker of CA125 and CA19-9 grade, and beta2-microglobulin (beta2 m), Various protein, such as ferritin and C reactive protein (CRP); Estradiol (E2), Estriol (E3), Homo sapiens chorionic gonadotropin (hCG), Various hormone, such as luteinizing hormone (LH) and Homo sapiens placenta lactogen (hPL); HBs antigen, Various virus-associated antigens, such as a HBs antibody, an HBe antigen, a HBe antibody, a HBc antibody, a HCV antibody, and a HIV antibody, or virus related antibody; Various allergen and IgE antibody specific to this; Narcotics nature drug, Medicine nature drugs and these metabolite; The nucleic acid of a virus and a disease related polynucleotide array etc. is illustrated. An electrolyte ion analysis method is an approach of analyzing electrolyte ion, such as a metal ion of Na ion, K ion, calcium ion, inorganic phosphorus, and others, by the colorimetric method or the ion electrode method. Although each of these analysis methods is analysis methods which can be used for the simple measuring device of this invention,

the analysis method which generates electrical signals, such as a current, potential, electric conductivity, and electric capacity, especially as a signal is suitable, especially when the configuration and analysis procedure of a simple measuring device can be simplified and it realizes a small and portable measuring device. The analysis method using various kinds of sensors known as the enzyme sensor which carries out a postscript, an immune sensor, a nucleic-acid sensor, a microbial sensor, a biosensor, an ion sensor, a chemical sensor, a semi-conductor sensor, an FET sensor, a gas sensor, etc. as an analysis method which outputs the electrical signal according to the device-under-test mass or concentration in a liquid sample is suitable. Also with the analysis method using these various sensors, various kinds of above mentioned quality of a device under test can be analyzed.

[0014] Therefore, as a liquid sample, it can extract from a living body, the various instantiation of the liquid with which existence of the quality of a device under test is expected is carried out, and, specifically, the secretion liquid from whole blood, a blood serum, plasma, urine, saliva, tear fluid, cerebrospinal fluid, mammary papilla, etc. is illustrated. in addition, the body fluid which extracted the liquid sample with which the measurement using the simple measuring device 10 of this invention is presented from the living body -- you may remain as it is and pretreatment of the thing diluted with diluents, such as a physiological saline, or centrifugal actuation, heating actuation, etc. or the reaction of an enzyme reaction or magnification reactions (polymerase chain reaction etc.) may be performed. Moreover, you may be the dissolution or the liquid sample suspended or extracted at dissolution liquids and solutions or extractant etc. which extracts the sample of solid-states, such as a cell and an organization, from a living body, for example, and contains this for the buffer solution, a physiological saline, a surfactant, etc.

[0015] As mentioned above, the sample tubing 14 holds such a liquid sample (extraction), in the example of illustration, consists of a body 18 of sample tubing, and a lid 19, makes a lid 19 a lower part (it sets for the example of illustration and is a slanting lower part) in the case of measurement, and the body 12 of equipment is equipped with it.

[0016] The body 18 of sample tubing is good with the container used for various kinds of medical-application measurement which consists of plastics, glass, etc. usual. In addition, it is inserted in slot 12c of the body 12 of equipment mentioned later, and projection 14a which specifies the stowed position of the sample tubing 14 to the body 12 of equipment is formed in the outer wall of the body 18 of sample tubing. If it is formed from elastic bodies, such as rubber system resin and a silicon film, and is easily punched by the introductory tubing 26 and the degassing tubing 28 of the analysis chip 16 which are mentioned later and these are extracted, it blockades, namely, a lid 19 is the same object as the lid with which the so-called reduced pressure blood collecting tubing etc. is equipped. In addition, the configuration of the sample tubing 14 has the available container which it is not limited to the example of illustration, but said introductory tubing 26 and the degassing tubing 28 penetrate some outer walls, and has various kinds of structures and configurations if insertion inside is possible. Especially, reduced pressure extraction tubing, such as reduced pressure blood collecting tubing, is suitably used in respect of the ease of liquid sample extraction etc. Moreover, by using the object of the same configuration as such a general-purpose article as sample tubing 14, coincidence can be followed, sampling for a series of clinical laboratory tests in a medical checkup etc. can be performed, and it is desirable in respect of improvement in a patient throughput, burden reduction of an inspected person, etc. Furthermore, when using reduced pressure blood collecting tubing as sample tubing 14, it is also desirable to put an anticoagulant or blood coagulation accelerant, a corpuscle separating medium, enzyme inhibitor, etc. into inside if needed.

[0017] The analysis chip 16 outputs the signal according to the device-under-test mass in the liquid sample held in the sample tubing 14, and consists of a body 20 of a chip, a connection means 22, and analyzor 24 fundamentally.

[0018] In the example of illustration, the connection means 22 and the analyzor 24 are formed in the body 20 of a chip. The connection means 22 is formed from the bleeder 30 which is open for free passage in the introductory tubing 26, the degassing tubing 28, and the degassing tubing 28, and makes the liquid sample in the sample tubing 14 introduce into the analyzor 24. The introductory tubing 26 is the capillary tube section which leads a liquid sample to the analyzor 24 from the sample tubing 14 by capillarity. In order to reinforce the capillarity of the introductory tubing 26, it is also desirable to process or coat the inside with a surface active agent, an amphiphilic compound, etc. On the other hand, since the bleeder 30 is formed as a large gap where it is degassing at the time of extracting a liquid sample from the sample tubing 14, and capillarity is not accepted with the introductory tubing 26, the degassing tubing 28 and a bleeder 30 cannot perform an outflow (back flow) in the direction where a liquid sample goes to a bleeder 30 from this degassing tubing 28. That is, the degassing tubing 28 is the capillary tube section which is equivalent to the bore of about 0.2-1.0mm like the introductory tubing 26, and a bleeder 30 is a large gap equivalent to the bore of about 2mm or more. however, the liquid sample of the optimal size is physical -- it changes according to descriptions (viscosity, content grain size, etc.). In order to prevent the back flow of the liquid

sample from a bleeder 30 or the degassing tubing 28, water-repellent coatings, such as a silicon coat, may be performed to the inside.

[0019] Both the tips of the introductory tubing 26 and the degassing tubing 28 are constituted so that it may have projected from the body 20 of a chip in the longitudinal direction in drawing (specifically parallel to the path of insertion of the analysis chip 16 mentioned later), and it may have a configuration with a sharp tip and the lid 19 of the sample tubing 14 by which insertion maintenance is carried out can be easily punched and penetrated to sample tubing insertion opening 12a of the body 12 of equipment mentioned later. Therefore, if chip insertion section 12c of the body 12 of equipment is inserted and equipped with the analysis chip 16, as shown in drawing 2 (b) and drawing 2 (c) When the tip of the introductory tubing 26 and the degassing tubing 28 punches and penetrates and the interior of the sample tubing 14 is decompressed, the lid 19 of the sample tubing 14 with which the body 12 of equipment is equipped beforehand The open air is attracted from the degassing tubing 28 or the introductory tubing 26, and air bubbles are generated in the sample tubing 14 interior, consequently sample tubing internal pressure becomes equal to an outside atmospheric pressure. Subsequently, a liquid sample permeates the introductory tubing 26 by capillarity, and a liquid sample is led to the analyzor 24 which is open for free passage by the capillary tube. Here, since the analyzor 24 is the strong part of the capillarity which consisted of the porous quality of the materials, such as a capillary tube or a filter paper, when the introductory tubing 26 and the analyzor 24 have connected (contact), a liquid sample permeates the analyzor 24 further, the reaction of the predetermined analyzor advances and it outputs the signal according to the device-under-test mass in a liquid sample (since it has passage). With osmosis of the introductory tubing 26 and the liquid sample to the analyzor 24, the open air is attracted by substitution from the degassing tubing 28, by going into the sample tubing 14 interior as air bubbles, sample tubing 14 internal pressure is adjusted and osmosis in the introductory tubing 26 and the analyzor 24 of a liquid sample is helped.

[0020] Such the introductory tubing 26 and the degassing tubing 28 are metal hollow needles, such as a hypodermic needle, or a hollow needle made from plastics, and may the body 20 (or the covering) of a chip, and really be fabricated. What is necessary is preferably, to pierce and just to produce a macromolecule sheet layered product so that lamination and a sharp tip may remain so that capillary tube structure and/, or a bleeder may be constituted inside when the analysis chip 16 is formed as a macromolecule sheet layered product or its punching articles, such as a PET (polyethylene terephthalate) film. This point is explained in full detail behind.

[0021] Although degassing is taken by the degassing tubing 28 and the bleeder 30 in the example of illustration As a configuration which damages some sample tubing 14 easily and can form a stoma in this invention besides this well-known approaches, such as the approach of making degassing unnecessary by compressing the sample tubing 14 and extruding a liquid sample in the introductory tubing 26, in case the approach and the body 12 of equipment which take degassing by this at the time of measurement are equipped, — various kinds — it is available. However, since there are problems, such as leakage of a subsequent liquid sample, when some sample tubing 14 is damaged, it is unsuitable when saving the sample tubing 14 after measurement termination. Moreover, although it has the configuration set for the example of illustration, and the connection means 22 is arranged and fixed by whose analysis chip 16, this invention may be the configuration that the connection means 22 is (part or all) arranged at the body 12 of equipment, or the sample tubing 14 besides this. What is necessary is just to set to the body 12 of equipment after extracting a liquid sample in the sample tubing 14, after attaching the connection means 22 in the lid 19 when the connection means 22 is arranged and fixed by the sample tubing 14. In this case, if the body 12 of equipment is equipped with the analysis chip 16, the connection means 22 will make the liquid sample of the sample tubing 14 interior, and the analyzor 24 of the analysis chip 16 open for free passage, and will serve as the configuration that a liquid sample is introduced into the analyzor 24. Moreover, when it is the configuration that the connection means 22 is arranged and fixed by the body 12 of equipment, before fixing the connection means 22 beforehand in the body 12 of equipment or installing the sample tubing 14, the DISUPOSABURU connection means 22 may be arranged and fixed at the body 12 of equipment. However, it is also one of the purposes to secure the simple nature in the case of processing many samples or much analysis continuously, and if time and effort, such as cleaning inside equipment, passage contamination, etc. are taken into consideration, it is not desirable [the simple measuring device 10 of this invention] that a direct liquid sample contacts the body 12 of equipment. Moreover, although mentioned later, the sample tubing 14 and the analysis chip 16 are throwing away (disposable) fundamentally. Therefore, when the leakage control of the liquid sample from this point and the sample tubing 14 is taken into consideration, as for the connection means 22, it is desirable to constitute so that the analysis chip 16 may be arranged and fixed, it may consider as the configuration which carries out direct continuation of the sample tubing 14 and the analysis chip 16, and introduces a liquid sample into the analysis chip 16 and a liquid sample may not contact any exteriors other than this.

[0022] The analyzor 24 is a part which outputs the signal according to the device-under-test mass in the liquid sample introduced by the connection means 22, and is located in the lower stream of a river of the flow direction of the liquid sample of the connection means 22 in the example of illustration. Here, in the simple measuring device 10 of this invention, there is especially no limitation in the generating (output) approach of a signal according to the device-under-test mass in the sample solution, i.e., the measuring method of the device-under-test mass in invention, and each well-known analysis method is available. The analysis method which generates electrical signals, such as a current, potential, electric conductivity, and electric capacity, as a signal even especially in inside is suitable, especially when the configuration and analysis procedure of a simple measuring device can be simplified and it realizes a small and portable measuring device. As an analysis method which outputs the electrical signal according to the device-under-test mass or concentration in a liquid sample An enzyme sensor, an immune sensor, a nucleic-acid sensor, a microbial sensor, a biosensor, An ion sensor, a chemical sensor, a semi-conductor sensor, an FET sensor, As a gas sensor etc. Various kinds of sensors known the used measurement is possible (it Turner (s) A. -- P.P. --) I. Karube and G.S.Wilson, Biosensors - Fundamentals and Applications and 1987; Electrochemical Sensors in Immunological Analysis, 1987; E.A.H.Hall, Biosensors, 1990; R.P.Buck, W.E.Hatfield, M.Umana, E.F.Bowden, and Biosensor Technology- Fundamentals and Applications. Moreover, generally these sensors can carry out the direct method of analysis of various kinds of liquid samples, and its analysis actuation itself is simple. Furthermore, if the liquid sample of the sample tubing 14 interior permeates the analyzor 24 through the introductory tubing 26, the measurement section 68 of the body 12 of equipment mentioned later can sense attainment of a liquid sample through these sensors. Therefore, the measuring device itself can detect the timing of analysis initiation correctly, and a signal output with a high precision according to the device-under-test mass in a liquid sample can be obtained only by an operating personnel equipping a measuring device with the sample tubing 14 and the analysis chip 16.
[0023] It is a measuring method using the specific reaction in which the quality of a device under test participates preferably, and the measuring method using a chemical reaction or a unique ligation reaction is mentioned as a specific reaction. Especially as a chemical reaction, in order to raise singularity and reactivity, the enzyme sensor measurement using biocatalyst molecules and living body functional molecules, such as an enzyme, etc. is mentioned. Although the specific adsorption reaction or specific binding reaction of a measured compound to coordination compounds, such as a functional thin film and a chelating agent, can be used as a unique ligation reaction, in order to raise especially singularity, bonding strength, and versatility, the immunoassay using living body functional molecules, such as an antibody, an acceptor, and a nucleic acid, nucleic-acid hybridization measurement, ligand-receptor measurement, etc. are mentioned, and immunoassay is especially mentioned in respect of versatility etc. as a desirable measuring method. Using the specific reaction of the quality of a device under test, as an approach of detecting the change according to the device-under-test mass by the reaction, in producing electric conductivity change by the reaction, when producing the potential difference for electric conductivity by the reaction and a reaction is an electrochemical reaction accompanied by an electronic transition for the potential difference, the analyzor 24 outputs these electrical signals that what is necessary is just to measure a current etc., respectively. An enzyme and the enzyme electrode which consists of electronic mediators are the desirable examples which can measure with an electrode the enzyme reaction in which the quality of a device under test participates as a current, and much instantiation is also in the above mentioned reference data. Moreover, the approach explained by each specification of JP,5-264552,A by these people, Japanese Patent Application No. No. 338626 [six to], and 7-162297 etc. in full detail as the amperometry approach using a unique ligation reaction is used preferably.
[0024] MEDIA hereafter indicated by JP,5-264552,A etc. -- the analyzor 24 using the electrochemical enzyme immunoassay known as law (Mediator Diffusion-controlled Immunoassay) is illustrated as an example. The outline decomposition perspective view of the analyzor 24 is shown in drawing 3 (a), and the outline side elevation of the analyzor 24 is shown in drawing 3 (b), respectively. Since according to this analyzor 24 blood is used as a liquid sample and the quantum of the amount of estradiols in blood (E2) can be carried out, it is used for an ovarian follicle degree-of-normality diagnosis etc.
[0025] In the analyzor 24 of the example of illustration, the circular cellulose filter paper which the mixed liquor of a hydrogen peroxide and a urea was infiltrated, and was freeze-dried is installed in the lowest layer as the absorption section 32. The circular liquid impermeable seal is stuck in the center of the drawing Nakagami side (let this field as a front face hereafter, and let a reverse side be a rear face) of the absorption section 32 as seal section 32a. On the absorption section 32, the estradiol insolubilization membrane 34 which is circular porosity has doubled and piled up the core.
[0026] The electrode substrate 36 piles up on the estradiol insolubilization membrane 34. The electrode substrate 36 comes to screen-stencil the ring-like silver electrode and ring-like carbon electrode which are formed in a core respectively in accordance with the front face and rear face of a PET film, a ring-like

silver electrode (counter electrode 38) is formed in a front face, and the ring-like carbon electrode (operation pole 40) is formed in this rear face, respectively. Furthermore, it flows in a counter electrode 38, counter electrode terminal 38a flows to the operation pole 40, and operation pole terminal 40a is formed, respectively. The ring-like polar zone (38 and 40) and the flow sections other than a terminal (38a and 40a) are covered with resist ink (illustration abbreviation), and are not exposed to a front face. Moreover, the electrode substrate 36 has the through tube 42 which has pierced through the center of two electrodes. In addition, as shown in drawing 1 and drawing 2 , the analysis chip 16 is constituted so that the edge by the side of the terminal of the electrode substrate 36 may project from the body 20 of a chip. The core of a through tube 42 is made in agreement with the core of the estradiol insolubilization membrane 34, and the laminating of the electrode substrate 36 is carried out.

[0027] On the electrode substrate 36, surfactant processing is carried out, and the laminating of the circular glass fiber filter paper 44 which sank in the buffer component and was freeze-dried is carried out so that the core may suit the core of a through tube 42. The circular liquid impermeable seal is stuck in the center of a front face of the glass fiber filter paper 44 as seal section 44a. On the glass fiber filter paper 44, the enzyme labelled antibody sinking-in section 46 which the mixed solution of a par oxidase enzyme-labeling estradiol antibody and an electronic mediator (N, N, N', and N'-tetrakis -(2'-hydroxyethyl)- p-phenylene diamine =THEPD) was infiltrated into the circular glass fiber filter paper, and was freeze-dried piles up a core together with a lower layer. Furthermore, the nonwoven fabric circularly cut on the enzyme labelled antibody sinking-in section 46 may be piled up as the filter section for removing an impurity if needed.

[0028] A liquid sample is introduced into the enzyme labelled antibody sinking-in section 46 from the sample tubing 14 with the introductory tubing 26. In addition, when it has the filter section on the enzyme labelled antibody sinking-in section 46, a liquid sample is introduced into the filter section, and foreign matters, such as an aggregate, are removed here and it is introduced into the enzyme labelled antibody sinking-in section 46. The liquid sample introduced into the enzyme labelled antibody sinking-in section 46 dissolves the enzyme labelled antibody and electronic mediator of the enzyme labelled antibody sinking-in section 46, bypasses seal 44a, and flows the glass fiber filter paper 44 in the direction of a core. The ligation reaction of the estradiol antigen in a liquid sample is carried out to this enzyme labelled antibody, and it forms antigen-enzyme labelled antibody complex in the meantime. Moreover, a corpuscle component etc. is caught within the glass fiber filter paper 44 and the enzyme labelled antibody sinking-in section 46. Further, a liquid sample passes the through tube 42 of the electrode substrate 36, goes into the estradiol insolubilization membrane 34, it bypasses seal section 32a on an inferior surface of tongue, permeates a periphery from a core in the inside of the estradiol insolubilization membrane 34 at a radial, is absorbed into the absorption section 32, and dissolves the enzyme substrate (hydrogen peroxide) of ten daily doses in the absorption section 32.

[0029] The enzyme-labeling structure of the isolation which did not form complex with the antigen estradiol in a liquid sample can form insolubilization estradiol and complex (complex of an insolubilization antigen-labelled antibody), in case a liquid sample permeates a radial in the inside of the estradiol insolubilization membrane 34. Therefore, in the estradiol insolubilization membrane 34, the joint distribution of marker enzyme is formed according to the amount of antigens. That is, the more there are few amounts of antigens in a liquid sample, the more marker enzyme shows the inclination localized to the core of the circular estradiol insolubilization membrane 34. On the contrary, the more there are many amounts of antigens in a liquid sample, the more marker enzyme is scattered all over the estradiol insolubilization membrane 34 whole.

[0030] In the analyzor 24 using this MEDIA method, an electronic mediator carries between the operation pole 40 of the shape of a ring which touched the core of the estradiol insolubilization membrane 34, and the marker enzyme distributed over the estradiol insolubilization membrane 34, and the oxidation reduction reaction of marker enzyme is measured as a current value. In the above-mentioned example, THEPD which is an electronic mediator carries cyclically the reaction to the hydrogen-peroxide substrate of the par oxidase which is marker enzyme, and the electrode reaction in the operation pole 40, and measures the reduction current of the electronic mediator produced on the operation pole 40 according to electrode reaction. Since it is dependent on the mass transfer by diffusion of an electronic mediator, it depends for this reduction current on the distance between an enzyme molecule and the operation pole 40 greatly. So, a current value becomes large, so that there are many marker enzyme molecules which there were few amounts of antigens in a specimen, and they localized to the core of the estradiol insolubilization membrane 34. On the contrary, a current value will become small, if there are many amounts of antigens in a specimen and marker enzyme molecules are scattered in the estradiol insolubilization membrane 34 whole. Therefore, the antigen concentration in a liquid sample can be calculated from the current value which is an electrical signal using the antigen concentration formula determined by analysis of the liquid

sample which contains the antigen of standard concentration beforehand.
[0031] Here, although use of an electrochemical reaction was illustrated about the analyzor 24, if it is the approach or the means which the signal according to the device-under-test mass in a specimen can be generated (output), it is available as analytical method of the simple measuring device of this invention as above-mentioned.
[0032] As mentioned above, such an analysis chip 16 can be formed as a macromolecule sheet layered product or its punching articles, such as a PET film. Based on the MEDIA method immunity analysis chip mentioned above, the example is shown in drawing 4 .
[0033] Analysis chip 16A shown in drawing 4 forms the above-mentioned analysis chip 16 and the analysis chip which has this function by carrying out the laminating of the sheet (tabular material) of seven sheets which has the shape of isomorphism mostly by the square system fundamentally in addition to said analyzor 24. As shown in drawing 4 , the square substrate 48 is arranged at the lowest layer of analysis chip 16A, on it, it is of the same shape as a substrate 48, and the laminating of the 1st attachment component 50 by which through tube 50a of the shape of absorption section 32 grade and isomorphism was formed in the center section is carried out. The absorption section 32 and the estradiol insolubilization membrane 34 of the analyzor 24 are inserted in through tube 50a, and are held. On this 1st attachment component 50, the laminating of the above-mentioned electrode substrate 36 is carried out, and the laminating of said 1st attachment component 50 and the 2nd attachment component 52 which has the same configuration is carried out on it. The above-mentioned glass fiber filter paper 44 and the above-mentioned enzyme labelled antibody sinking-in section 46 are inserted in through tube 52a of the 2nd attachment component 52, and the above-mentioned analyzor 24 is constituted.
[0034] On the 2nd attachment component 52, it is almost of the same shape as a substrate 48, and the laminating of the 1st plate-like part material 54 in which heights 54b which has a sharp taper-like tip to the left in drawing (analysis chip path of insertion) was formed is carried out. Moreover, through tube 54a for being open for free passage with the enzyme labelled antibody sinking-in section 46 is formed in that core at this 1st plate-like part material 54. On the 1st plate-like part material 54, the laminating of the introductory plate 56 which has the same appearance configuration as this is carried out, and the laminating of the 1st plate-like part material 54 and the isomorphism-like 2nd plate-like part material 58 is carried out on this introductory plate 56 except not having through tube 54a. Introductory slot 56c which penetrates the introductory plate 56 up and down, and extends from the tip of heights 56b to the location corresponding to through tube 54a of the 1st plate-like part material 54 is formed in the introductory plate 56. That is, in analysis chip 16A of the example of illustration, by inserting the introductory plate 56 by up-and-down plate-like part material, the introductory capillary-like tubing 26 is formed, and a liquid sample flows introductory slot 56c, and is introduced into the analyzor 24 (enzyme labelled antibody sinking-in section 46) from through tube 54a.
[0035] On the 2nd plate-like part material 58, the laminating of the degassing plate 60 of the same appearance configuration as this is carried out, and the laminating of the 2nd plate-like part material 58 and the same 3rd plate-like part material 62 is carried out on the degassing plate 60 except having square punching section 62a in the center. Furthermore, on the 3rd plate-like part material 62, the laminating of the spacer 64 which there is some thickness and has punching section 62a and isomorphism-like space 64a is carried out, the laminating of a substrate 48 and the up isomorphism-like covering 66 is carried out, and analysis chip 16A is formed at the top, i.e., the maximum upper layer of analysis chip 16A. Degassing slot 60c which penetrates the degassing plate 60 up and down to this degassing plate 60, and extends to it from the tip of heights 60b to the location corresponding to said space 64a (punching section 62a) is formed, further, from the location corresponding to space 64a, 60d of slots opened outside penetrates the degassing plate 60 in the method edge of the right up and down, and they are formed in it. Namely, the degassing tubing 28 is formed by pinching the degassing plate 60 which has slot 60b which results in space 64a in analysis chip 16A of the example of illustration by the 2nd plate-like part material 58 and the 3rd plate-like part material 62. Furthermore, by pinching the 3rd plate-like part material 62 which has the spacer 64 and punching section 62a which have space 64a with the degassing plate 60 and the up covering 66, a bleeder 30 is formed and it opens outside by 60d of slots.
[0036] the ingredient which especially limitation does not have in the ingredient of the tabular material which forms such analysis chip 16A, can secure the rigidity to which the heights which fully form reservation especially the introductory tubing 26, and the degassing tubing 28 for rigidity can punch the lid 19 of the sample tubing 14 easily, and does not affect measurement — various kinds — although it is available, metallic materials, such as various kinds of resin ingredients, such as the above-mentioned PET, and stainless steel, etc. are illustrated, for example.
[0037] Wearing of such both sample tubing 14 and analysis chips 16 on the body 12 of equipment is enabled. In the example of illustration, the above-mentioned sample tubing insertion opening 12a for

equipping with the sample tubing 14 is formed in the side face (left-hand side in drawing 1) of the body 12 of equipment, and in order to equip with the analysis chip 16, chip insertion section 12b is formed in the confrontation. Furthermore, the ejection device 74 for discharging the measurement section 68 which measures and processes the electrical signal outputted to this body 12 of equipment from the analysis chip 16, the operation part 70 which calculates the output signal from the measurement section 68, and is made into a measurement result, the display panel 72 which displays a measurement result, and the analysis chip 16 with which the body 12 of equipment was equipped is arranged.

[0038] Sample tubing insertion opening 12a has the almost same diameter as the sample tubing 14, it is a cylinder-like through tube from the left lateral upper part in drawing of the body 12 of equipment to chip insertion section 12b toward a slanting lower part, and sample tubing 14 is made removable on the body 12 of equipment as mentioned above by being inserted and removed from this sample tubing insertion opening 12a. Moreover, when projection 14a is formed in the peripheral face of the sample tubing 14, slot 12c corresponding to this is formed in the internal surface of sample tubing insertion opening 12a, the sample tubing 14 is inserted, and the sample tubing 14 path-of-insertion edge of slot 12c and projection 14a contact, insertion of the sample tubing 14 is regulated, and it is held and is fixed to a predetermined insertion point. In addition, in this invention, the rib and concave which engage with the sample tubing 14 and sample tubing insertion opening 12a mutually are formed if needed. Or when the body 12 of equipment is equipped with the sample tubing 14 by making the sample tubing 14 and sample tubing insertion opening 12a into the size (path) which fits in loosely mutually, it is good also as a configuration which can hold the sample tubing 14 certainly.

[0039] On the other hand, chip insertion section 12b is opening which can insert the analysis chip 16, as shown in drawing 2 , holds the analysis chip 16 in the location which the connection section 22 can insert into the sample tubing 14, and holds this. In addition, it is good also considering wearing of the analysis chip 16 to the body 12 of equipment as a more positive thing by the approach that the approach of forming the projection (the sign y in drawing 1) which engages with chip insertion section 12b and the analysis chip 16 mutually, and a crevice (sign x in drawing 1) if needed etc. is well-known. Moreover, press of other members may constitute Projection y possible [receipt] in chip insertion section 12b Kabeuchi. Here, 12d of slots where the part which projects from the analysis chip 16 of the electrode substrate 36 is inserted in the termination of the analysis chip 16 path of insertion of chip insertion section 12b is formed. That is, counter electrode terminal 38a of the analysis chip 16 and operation pole terminal 40a are inserted in 12d of this slot, and are electrically connected to the measurement section 68 with a well-known means, respectively.

[0040] The equipment of the example of illustration has the ejection device 74 for discharging the analysis chip 16 with which the body 12 (chip insertion section 12b) of equipment was equipped as a desirable mode. There is especially no limitation in the ejection device 74, and all well-known things, such as a mechanical push means using a cam mechanism, a link mechanism, etc., are available in it. Moreover, it is good also as a configuration which discharges the analysis chip 16 by energizing the analysis chip 16 with which the body 12 of equipment was equipped to an eject direction by a spring etc., considering as the configuration which presses this down by hook etc. and equips the body 12 of equipment with the analysis (locking) chip 16, and canceling the lock by this hook etc.

[0041] As mentioned above, counter electrode terminal 38a and operation pole terminal 40a are electrically connected to the measurement section 68 by being inserted in 12d of terminal area fang furrows of the electrode substrate 36 of the analysis chip 16. The measurement section 68 detects insertion into 12d of slots of this electrode substrate terminal area, and is measurable. The measurement section 68 impresses potential if needed between counter electrode terminal 38a and operation station terminal 74a, measures the electrical signal further outputted from the analysis chip 16 (counter electrode terminal 38a and operation pole terminal 40a), performs required processing of A/D conversion etc., and outputs it to operation part 70. In operation part 70, it has the timer or the counter, after detecting the attainment to the operation pole 40 of a liquid sample, the output signal from the measurement section 68 is calculated after predetermined time, and it considers as a measurement result, and this measurement result is displayed on a display panel 72. In addition, in the simple measuring device 10 of this invention, the measurement result displayed on a display panel 72 may display measured value as it is, may display easy messages, such as a positivity or negative, normal, or abnormalities, and may display the both. Furthermore, you may be the message which gives directions to an operating personnel as shown in the international public presentation number WO 95/No. 16970 specification as these messages, or a command. Moreover, all well-known displays, such as a liquid crystal display and a display using LED as a display panel 72, are available.

[0042] Although the simple measuring device 10 concerning this invention has such a configuration fundamentally, it explains the operation hereafter. In the simple measuring device 10 of the example of

illustration, first, as shown in drawing 1 – drawing 2 (b), the sample tubing 14 is inserted in test tube insertion opening 12a, and the body 12 of equipment is equipped with the sample tubing 14. At this time, the inclination is attached to test tube insertion opening 12a as mentioned above so that it may be equipped with the sample tubing 14 with an include angle for a while from a horizontal plane. Thereby, the liquid sample in the sample tubing 14 can be analyzed without futility. Subsequently, as shown in drawing 2 (c), chip insertion section 12b of the body 12 of equipment is inserted and equipped with the analysis chip 16. By this, the connection means 22 (the introductory tubing 26 and degassing tubing 28) penetrates the lid 19 of the sample tubing 14, the interior is reached, and a liquid sample flows into the analyzor 24 from the introductory tubing 26. It is inserted in counter electrode terminal 38a of the analysis chip 16, and 12d of operation pole terminal 40a fang furrows, and connects with coincidence electrically at the measurement section 68. If a liquid sample flows into the analyzor 24, as previously explained with reference to drawing 3 , the electrical signal according to the device–under–test mass in a liquid sample is outputted to the measurement section 68 from counter electrode terminal 38a and operation pole terminal 40a, and a measurement result is outputted to operation part 70, and a measurement result will calculate and it will be outputted to a display panel 72. Thus, if measurement is completed, according to the ejection device 74, the analysis chip 16 will be discharged from the body 12 of equipment, and the sample tubing 14 will be drawn out and removed from the body 12 of equipment. Another inspection is presented with the sample tubing 14, or it is discarded. On the other hand, the analysis chip 16 is discarded. In addition, what is necessary is just to measure by equipping with the analysis chip corresponding to the next measurement, equipping the body 12 of equipment with the sample tubing 14, in performing another analysis continuously to the same sample.

[0043] Various kinds of configurations are possible for the simple measuring device of this invention besides the example of a configuration explained above. The example is illustrated below. In addition, since the example shown below has the same configuration as the above–mentioned simple measuring device 10 fundamentally except that the sample tubing 14 and the wearing approach of the analysis chip 16 differ from the arrangement location of each part material etc., the same sign is given to the same member and the following explanation mainly performs a different part.

[0044] The simple measuring device 76 shown in drawing 5 and drawing 6 has the configuration which equips with the sample tubing 14 from the upper part of the body 78 of equipment, and cylinder–like sample tubing insertion opening 78a penetrates the top face of the body 78 of equipment, therefore it is formed. Moreover, maintenance hole 80a corresponding to sample tubing insertion opening 78a is formed also in the up core of the body 82 of a chip of the analysis chip 80, and the connection means 22 is projected and formed toward the upper part at the core of this maintenance hole 80a.

[0045] In this simple measuring device 76, first, as shown in drawing 5 – drawing 6 (b), chip insertion section 78a of the body 78 of equipment is equipped with the analysis chip 80. Moreover, thereby, the electrode substrate 60 of the analysis chip 80 is inserted in 78d of slots of chip insertion section 78a, and both are connected electrically. Subsequently, as shown in drawing 6 (b) – (c), a lid 19 is carried out caudad, maintenance hole 80a from sample tubing insertion opening 78a is inserted and equipped with the sample tubing 14, thereby, the connection means 22 is inserted into the sample tubing 14, and measurement is performed like the point.

[0046] On the other hand, the simple measuring device 84 shown in drawing 7 and drawing 8 constitutes the body 86 of equipment possible [closing motion] in the shape of a hinge. In the simple measuring device 84 which has this configuration, as first shown in drawing 7 (a) – (b), the sample tubing 14 is fixed to sample tubing insertion opening 86a of the body 86 of equipment. Here, in this mode, the sample tubing 14 is held comparatively firmly at sample tubing insertion opening 86a. Subsequently, as shown in drawing 7 (b) – drawing 8 (c), the protective cap 90 of the analysis chip 88 is removed, the body 86 of equipment is opened wide, the analysis chip 88 is contained to chip insertion section 86c, and subsequently to drawing 8 (d), the body 86 of equipment is blockaded so that it may be shown. Thereby, the connection means 22 is inserted into the sample tubing 14, and measurement is performed like the point. In addition, the analysis chip 88 is set to the example of the book with which it equips from the upper part. Cannot project the electrode substrate 60 from the analysis chip 88, but counter electrode terminal 38a and operation pole terminal 40a have composition exposed to the side face of the analysis chip 88. When the terminal and both–ends child who are stationed at the medial surface of insertion section 86b contact electrically, the measurement section 68, counter electrode terminal 38a, and operation pole terminal 40a are connected electrically.

[0047] Although the simple measuring device concerning this invention explained above is flowing the liquid sample to an analysis chip by capillarity, this invention is not limited to this configuration, but may flow the liquid sample to an analysis chip using means by which the pump etc. was used, such as suction and extrusion, gravity, etc.

[0048] Although use of an electrochemical reaction was illustrated about the analyzor 24 in the above example, if it is the approach or the means which the signal according to the device-under-test mass in a specimen can be generated (output), it is available as analytical method of the simple measuring device of this invention as above-mentioned. The well-known color difference meter with which, as for the measurement section 68 of the body 12 of equipment, a signal consists of a photomultiplier tube, a photodiode, light emitting diode, semiconductor laser, etc. in coloration, fluorescence, luminescence, etc., and a photometer are used.

[0049] As mentioned above, although the simple measuring device of this invention was explained, this invention of various kinds of amelioration and modification being made is natural in the range which limitation is not carried out to this and does not deviate from the summary of this invention.

[0050] For example, it can also make it easy to extend or improve the above-mentioned simple measuring device to the equipment in which the coincidence measurement of two or more specimens is possible. In the simple measuring device for two or more specimens, it has two or more chip insertion sections corresponding to sample insertion opening and it which have the same configuration as the above-mentioned simple measuring device, and can analyze by interlocking independently, respectively. With such equipment for two or more specimen coincidence measurement, by unifying the measurement section, operation part, or a display panel, the configuration of a measuring device may be simplified, the chip insertion section corresponding to two or more sample insertion openings and it may be circularly arranged on a karroo cel, and operability etc. may be raised. Or two or more measuring devices for the above-mentioned unit specimens may consist of external computers controllable. In this case, as long as the throughput of a computer allows, since an operating personnel makes extended connection of the measuring device free according to a measurement situation or a measurement scale, downloads a measurement result to a computer and data processing of it is possible, the efficient clinical laboratory test business of it becomes possible. Anyway, since a liquid sample is automatically introduced into the analyzor, installation of the liquid sample is detected automatically, measurement is started and data processing of the measurement result is automatically carried out when a measuring device is equipped with an analysis chip and sample tubing as the example of the measuring device for unit specimens described, even when it is an object for two or more specimens, it becomes a very highly independent gaging system. That is, if sample tubing insertion opening which has **ed on the measuring device is equipped with sample tubing and it equips with the analysis chip corresponding to the item which should be measured when the specimen which should be measured occurs, a measurement result will be obtained automatically. Therefore, the simple measuring device of this invention pours a liquid sample distributively from sample tubing to a reaction container, and it can provide considering the two or more specimen multi-item random-access function and the interruption measurement which required conventional processing or the procedure of the type which processes and measures a reaction container with reaction Rhine and the migration means which consists of a reagent solution distributive-pouring process, an incubation process, a washing process, a measurement process, etc. complicated at a full automatic analysis apparatus etc. as very easy small equipment.

[0051]

[Effect of the Invention] As mentioned above, as explained to the detail, according to the simple measuring device of this invention which has the above-mentioned configuration, it can measure by simple actuation of equipping the body of equipment with an analysis chip and sample tubing, and moreover, since an analysis chip is throwing away fundamentally, a maintenance etc. is possible in it being almost unnecessary, and medical-application measurement of the immunoassay which makes blood, urine, etc. a sample can be quickly carried out by easy actuation.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention belongs to the measurement fields which measure the quality of a device under test in the sample extracted from living bodies, such as blood and urine, such as immunoassay, and relates to the simple measuring device suitable for the medical-application way which can measure simply and quickly the quality of a device under test in a sample.

[Translation done.]

PRIOR ART

[Description of the Prior Art] A blood sample required for a clinical laboratory test is extracted using disposable reduced pressure blood collecting tubing in many cases. There is no need for glass syringe syringe actuation, this reduced pressure blood collecting tubing is simple, and its burden of a blood collecting person is effective also in prevention of an infection medical accident few. However, in order to conduct the clinical laboratory test of the blood sample extracted in reduced pressure blood collecting tubing, the unstopping activity which removes a blood collecting tubing lid is required, and the complicatedness of the activity phase and the danger of an infection medical accident are left behind as a trouble.

[0003] Therefore, development of unstopping tools was performed, and the suction nozzle which can isolate the sample inside blood collecting tubing preparatively was developed further, without removing the lid of reduced pressure blood collecting tubing (refer to each official report of JP,6-182234,A and 6-300670). Moreover, the automatic analyzer of the cap pierced earring method which can install reduced pressure blood collecting tubing as it is was developed as automation of a clinical laboratory test progressed. The automatic analyzer which consists of a migration means to hold reduced pressure blood collecting tubing which extracted the blood sample as such an automatic analyzer, and to transport to a predetermined location, a blood serum separation means, and a suction nozzle that attracts the specimen in blood collecting tubing and is poured distributively for a blood serum separation means or an analysis means is known (refer to each official report of JP,2-75959,A and 6-123741). However, these suction nozzles and automatic analyzers operate a suction nozzle, or require the drive for making a reduced pressure blood collecting tubing electrode holder transport, and have a problem in respect of the miniaturization of equipment, or cost.

[0004] On the other hand, some simple reduced pressure blood collecting tubing auxiliary implements which do not need a drive were also developed. For example, the auxiliary implement which introduces the blood sample in reduced pressure blood collecting tubing to the predetermined location of WESUTA grain measurement tubing for erythrocyte sedimentation rate measurement is known (refer to JP,3-17557,A). Moreover, the plug of reduced pressure blood collecting tubing which makes the slide glass smear of a blood sample easy is known (refer to JP,6-265541,A). However, these are the techniques about the sampling method in reduced pressure blood collecting tubing, and the measuring device which can conduct various general clinical laboratory tests, such as a blood test, biochemical inspection, and immunochemistry inspection, simple small is not realized using the blood extracted by reduced pressure blood collecting tubing.

EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, as explained to the detail, according to the simple measuring device of this invention which has the above-mentioned configuration, it can measure by simple actuation of equipping the body of equipment with an analysis chip and sample tubing, and moreover, since an analysis chip is throwing away fundamentally, a maintenance etc. is possible in it being almost unnecessary, and medical-application measurement of the immunoassay which makes blood, urine, etc. a sample can be quickly carried out by easy actuation.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The purpose of this invention is to solve the trouble of said conventional technique, it can perform quickly medical-application measurement of the immunoassay which makes blood, urine, etc. a sample by easy actuation, and, moreover, offering the simple measuring device suitable for a possible medical-application way also has a miniaturization.

[Translation done.]

MEANS

[Means for Solving the Problem] Sample tubing with which this invention holds a liquid sample in order to attain said purpose, The analysis chip which outputs the signal according to the device-under-test mass in the liquid sample held in said sample tubing, The body of equipment which can detach and attach said sample tubing and the analysis chip which calculate the device-under-test mass in said liquid sample, and output or display a measurement result from the signal outputted from said analysis chip, When the body of equipment is equipped with said sample tubing and an analysis chip, the simple measuring device suitable for the medical-application way characterized by having a connection means to open for free passage the interior in which the liquid sample of said sample tubing is held, and an analysis chip is offered.
[0007] Moreover, it is desirable that said sample tubing is reduced pressure extraction tubing.
[0008] Moreover, it is desirable that it is the capillary section in which it has the lid formed from the elastic body with which the formed hole is blockaded when the member in which said sample tubing has a sharp tip can penetrate easily and extracts the member of a parenthesis, and said connection means has the sharp tip fixed to said analysis chip.
[0009] Furthermore, it is desirable that the signal which said analysis chip outputs is an electrical signal.
[0010]
[Embodiment of the Invention] Hereafter, the simple measuring device of this invention is explained to a detail. The outline top view of an example of the simple measuring device of this invention is shown in drawing 1 (a-I), and this II-II line outline sectional view is shown in drawing 1 (a-II), respectively.
[0011] As shown in drawing 1 , the simple measuring device 10 of this invention consists of analysis chips 16 which output the signal according to the amount of the quality of a device under test (analysis object) which exists in the liquid sample in the body 12 of equipment, the sample tubing 14 which holds a liquid sample, and the sample tubing 14 fundamentally. Moreover, the sample tubing 14 and the analysis chip 16 are constituted removable by both the bodies 12 of equipment.
[0012] The sample tubing 14 is a container with which a liquid sample is held. In addition, in the simple measuring device 10 of this invention, there is especially no limitation in the quality of a device under test, i.e., an analysis object, and all the matter in which the analytical method that the analysis chip introduced in the liquid sample generates the signal which has the signal strength or the signal property according to device-under-test mass in a liquid sample is possible is contained in it in various kinds of measurement, such as medical-application measurement of a blood test, biochemical inspection, immunochemistry inspection, etc. Moreover, as a signal, electrical signals, such as coloration, fluorescence, luminescence or a current, potential, electric conductivity, and electric capacity, etc. are illustrated. In the example of illustration of drawing 1 , the case where the signal which the analysis chip 16 outputs is an electrical signal is illustrated. Furthermore, as analytical method, there are a biochemical reaction analysis method represented by the enzyme analysis method etc., a unique joint analysis method represented by the immunity analysis method, an electrolyte ion analysis method, etc., for example.
[0013] The quality of a device under test an enzyme analysis method An enzyme substrate, a coenzyme, enzyme cofactor, the quality of an enzyme activity ghost, It is enzyme inhibitor or the enzyme itself, and is an analysis method adapting the signal strength or the signal property which an enzyme reaction emits according to device-under-test mass changing. The triglyceride (TG) analysis using cholesterol analysis, lipase, a glycerokinase, etc. using cholesterol oxidase etc., Analysis of the blood coagulation factor which is the urine sugar using uric-acid analysis, glucose oxidase, etc. using uricase etc. or blood sugar analysis, and a proteolytic enzyme, or its inhibitor etc. is illustrated. As represented by the so-called immunity analysis method using an antigen-antibody reaction etc., a unique joint analysis method is an analysis method using a unique ligation reaction with the unique cementing material specifically combined with an analysis object and said analysis object, and is an analysis method adapting signal strength or a signal property changing according to the unique ligation reaction of an analysis object and a unique cementing material. The nucleic acids which can be analyzed with nucleic-acid hybridization analysis methods, such as the various protein,

a polypeptide, glycoprotein, polysaccharide, a compound glycolipid, or various haptens as the antibody which can be analyzed with an immunity analysis method, and an antigen, as quality of a device under test which can be analyzed with a unique joint analysis method and the ligand molecule which can be analyzed with other ligand receptor joint analysis methods, an effector molecule, a receptor molecule, etc. are illustrated. Still more specifically Alpha fetoprotein, a carcinoembryonic antigen (CEA), The tumor marker of CA125 and CA19-9 grade, and beta2-microglobulin (beta2 m), Various protein, such as ferritin and C reactive protein (CRP); Estradiol (E2), Estriol (E3), Homo sapiens chorionic gonadotropin (hCG), Various hormone, such as luteinizing hormone (LH) and Homo sapiens placenta lactogen (hPL); HBs antigen, Various virus-associated antigens, such as a HBs antibody, an HBe antigen, a HBe antibody, a HBc antibody, a HCV antibody, and a HIV antibody, or virus related antibody; Various allergen and IgE antibody specific to this; Narcotics nature drug, Medicine nature drugs and these metabolite; The nucleic acid of a virus and a disease related polynucleotide array etc. is illustrated. An electrolyte ion analysis method is an approach of analyzing electrolyte ion, such as a metal ion of Na ion, K ion, calcium ion, inorganic phosphorus, and others, by the colorimetric method or the ion electrode method. Although each of these analysis methods is analysis methods which can be used for the simple measuring device of this invention, the analysis method which generates electrical signals, such as a current, potential, electric conductivity, and electric capacity, especially as a signal is suitable, especially when the configuration and analysis procedure of a simple measuring device can be simplified and it realizes a small and portable measuring device. The analysis method using various kinds of sensors known as the enzyme sensor which carries out a postscript, an immune sensor, a nucleic-acid sensor, a microbial sensor, a biosensor, an ion sensor, a chemical sensor, a semi-conductor sensor, an FET sensor, a gas sensor, etc. as an analysis method which outputs the electrical signal according to the device-under-test mass or concentration in a liquid sample is suitable. Also with the analysis method using these various sensors, various kinds of above mentioned quality of a device under test can be analyzed.

[0014] Therefore, as a liquid sample, it can extract from a living body, the various instantiation of the liquid with which existence of the quality of a device under test is expected is carried out, and, specifically, the secretion liquid from whole blood, a blood serum, plasma, urine, saliva, tear fluid, cerebrospinal fluid, mammary papilla, etc. is illustrated. in addition, the body fluid which extracted the liquid sample with which the measurement using the simple measuring device 10 of this invention is presented from the living body -- you may remain as it is and pretreatment of the thing diluted with diluents, such as a physiological saline, or centrifugal actuation, heating actuation, etc. or the reaction of an enzyme reaction or magnification reactions (polymerase chain reaction etc.) may be performed. Moreover, you may be the dissolution or the liquid sample suspended or extracted at dissolution liquids and solutions or extractant etc. which extracts the sample of solid-states, such as a cell and an organization, from a living body, for example, and contains this for the buffer solution, a physiological saline, a surfactant, etc.

[0015] As mentioned above, the sample tubing 14 holds such a liquid sample (extraction), in the example of illustration, consists of a body 18 of sample tubing, and a lid 19, makes a lid 19 a lower part (it sets for the example of illustration and is a slanting lower part) in the case of measurement, and the body 12 of equipment is equipped with it.

[0016] The body 18 of sample tubing is good with the container used for various kinds of medical-application measurement which consists of plastics, glass, etc. usual. In addition, it is inserted in slot 12c of the body 12 of equipment mentioned later, and projection 14a which specifies the stowed position of the sample tubing 14 to the body 12 of equipment is formed in the outer wall of the body 18 of sample tubing. If it is formed from elastic bodies, such as rubber system resin and a silicon film, and is easily punched by the introductory tubing 26 and the degassing tubing 28 of the analysis chip 16 which are mentioned later and these are extracted, it blockades, namely, a lid 19 is the same object as the lid with which the so-called reduced pressure blood collecting tubing etc. is equipped. In addition, the configuration of the sample tubing 14 has the available container which it is not limited to the example of illustration, but said introductory tubing 26 and the degassing tubing 28 penetrate some outer walls, and has various kinds of structures and configurations if insertion inside is possible. Especially, reduced pressure extraction tubing, such as reduced pressure blood collecting tubing, is suitably used in respect of the ease of liquid sample extraction etc. Moreover, by using the object of the same configuration as such a general-purpose article as sample tubing 14, coincidence can be followed, sampling for a series of clinical laboratory tests in a medical checkup etc. can be performed, and it is desirable in respect of improvement in a patient throughput, burden reduction of an inspected person, etc. Furthermore, when using reduced pressure blood collecting tubing as sample tubing 14, it is also desirable to put an anticoagulant or blood coagulation accelerant, a corpuscle separating medium, enzyme inhibitor, etc. into inside if needed.

[0017] The analysis chip 16 outputs the signal according to the device-under-test mass in the liquid sample held in the sample tubing 14, and consists of a body 20 of a chip, a connection means 22, and

analyzor 24 fundamentally.
[0018] In the example of illustration, the connection means 22 and the analyzor 24 are formed in the body 20 of a chip. The connection means 22 is formed from the bleeder 30 which is open for free passage in the introductory tubing 26, the degassing tubing 28, and the degassing tubing 28, and makes the liquid sample in the sample tubing 14 introduce into the analyzor 24. The introductory tubing 26 is the capillary tube section which leads a liquid sample to the analyzor 24 from the sample tubing 14 by capillarity. In order to reinforce the capillarity of the introductory tubing 26, it is also desirable to process or coat the inside with a surface active agent, an amphiphilic compound, etc. On the other hand, since the bleeder 30 is formed as a large gap where it is degassing at the time of extracting a liquid sample from the sample tubing 14, and capillarity is not accepted with the introductory tubing 26, the degassing tubing 28 and a bleeder 30 cannot perform an outflow (back flow) in the direction where a liquid sample goes to a bleeder 30 from this degassing tubing 28. That is, the degassing tubing 28 is the capillary tube section which is equivalent to the bore of about 0.2–1.0mm like the introductory tubing 26, and a bleeder 30 is a large gap equivalent to the bore of about 2mm or more. however, the liquid sample of the optimal size is physical — it changes according to descriptions (viscosity, content grain size, etc.). In order to prevent the back flow of the liquid sample from a bleeder 30 or the degassing tubing 28, water–repellent coatings, such as a silicon coat, may be performed to the inside.
[0019] Both the tips of the introductory tubing 26 and the degassing tubing 28 are constituted so that it may have projected from the body 20 of a chip in the longitudinal direction in drawing (specifically parallel to the path of insertion of the analysis chip 16 mentioned later), and it may have a configuration with a sharp tip and the lid 19 of the sample tubing 14 by which insertion maintenance is carried out can be easily punched and penetrated to sample tubing insertion opening 12a of the body 12 of equipment mentioned later. Therefore, if chip insertion section 12c of the body 12 of equipment is inserted and equipped with the analysis chip 16, as shown in drawing 2 (b) and drawing 2 (c) When the tip of the introductory tubing 26 and the degassing tubing 28 punches and penetrates and the interior of the sample tubing 14 is decompressed, the lid 19 of the sample tubing 14 with which the body 12 of equipment is equipped beforehand The open air is attracted from the degassing tubing 28 or the introductory tubing 26, and air bubbles are generated in the sample tubing 14 interior, consequently sample tubing internal pressure becomes equal to an outside atmospheric pressure. Subsequently, a liquid sample permeates the introductory tubing 26 by capillarity, and a liquid sample is led to the analyzor 24 which is open for free passage by the capillary tube. Here, since the analyzor 24 is the strong part of the capillarity which consisted of the porous quality of the materials, such as a capillary tube or a filter paper, when the introductory tubing 26 and the analyzor 24 have connected (contact), a liquid sample permeates the analyzor 24 further, the reaction of the predetermined analyzor advances and it outputs the signal according to the device–under–test mass in a liquid sample (since it has passage). With osmosis of the introductory tubing 26 and the liquid sample to the analyzor 24, the open air is attracted by substitution from the degassing tubing 28, by going into the sample tubing 14 interior as air bubbles, sample tubing 14 internal pressure is adjusted and osmosis in the introductory tubing 26 and the analyzor 24 of a liquid sample is helped.
[0020] Such the introductory tubing 26 and the degassing tubing 28 are metal hollow needles, such as a hypodermic needle, or a hollow needle made from plastics, and may the body 20 (or the covering) of a chip, and really be fabricated. What is necessary is preferably, to pierce and just to produce a macromolecule sheet layered product so that lamination and a sharp tip may remain so that capillary tube structure and/, or a bleeder may be constituted inside when the analysis chip 16 is formed as a macromolecule sheet layered product or its punching articles, such as a PET (polyethylene terephthalate) film. This point is explained in full detail behind.
[0021] Although degassing is taken by the degassing tubing 28 and the bleeder 30 in the example of illustration As a configuration which damages some sample tubing 14 easily and can form a stoma in this invention besides this well–known approaches, such as the approach of making degassing unnecessary by compressing the sample tubing 14 and extruding a liquid sample in the introductory tubing 26, in case the approach and the body 12 of equipment which take degassing by this at the time of measurement are equipped, — various kinds — it is available. However, since there are problems, such as leakage of a subsequent liquid sample, when some sample tubing 14 is damaged, it is unsuitable when saving the sample tubing 14 after measurement termination. Moreover, although it has the configuration set for the example of illustration, and the connection means 22 is arranged and fixed by whose analysis chip 16, this invention may be the configuration that the connection means 22 is (part or all) arranged at the body 12 of equipment, or the sample tubing 14 besides this. What is necessary is just to set to the body 12 of equipment after extracting a liquid sample in the sample tubing 14, after attaching the connection means 22 in the lid 19 when the connection means 22 is arranged and fixed by the sample tubing 14. In this case, if the body 12 of equipment is equipped with the analysis chip 16, the connection means 22 will make the

iquid sample of the sample tubing 14 interior, and the analyzor 24 of the analysis chip 16 open for free passage, and will serve as the configuration that a liquid sample is introduced into the analyzor 24. Moreover, when it is the configuration that the connection means 22 is arranged and fixed by the body 12 of equipment, before fixing the connection means 22 beforehand in the body 12 of equipment or installing the sample tubing 14, the DISUPOSABURU connection means 22 may be arranged and fixed at the body 12 of equipment. However, it is also one of the purposes to secure the simple nature in the case of processing many samples or much analysis continuously, and if time and effort, such as cleaning inside equipment, passage contamination, etc. are taken into consideration, it is not desirable [the simple measuring device 10 of this invention] that a direct liquid sample contacts the body 12 of equipment. Moreover, although mentioned later, the sample tubing 14 and the analysis chip 16 are throwing away (disposable) fundamentally. Therefore, when the leakage control of the liquid sample from this point and the sample tubing 14 is taken into consideration, as for the connection means 22, it is desirable to constitute so that the analysis chip 16 may be arranged and fixed, it may consider as the configuration which carries out direct continuation of the sample tubing 14 and the analysis chip 16, and introduces a liquid sample into the analysis chip 16 and a liquid sample may not contact any exteriors other than this.

[0022] The analyzor 24 is a part which outputs the signal according to the device-under-test mass in the liquid sample introduced by the connection means 22, and is located in the lower stream of a river of the flow direction of the liquid sample of the connection means 22 in the example of illustration. Here, in the simple measuring device 10 of this invention, there is especially no limitation in the generating (output) approach of a signal according to the device-under-test mass in the sample solution, i.e., the measuring method of the device-under-test mass in invention, and each well-known analysis method is available. The analysis method which generates electrical signals, such as a current, potential, electric conductivity, and electric capacity, as a signal even especially in inside is suitable, especially when the configuration and analysis procedure of a simple measuring device can be simplified and it realizes a small and portable measuring device. As an analysis method which outputs the electrical signal according to the device-under-test mass or concentration in a liquid sample An enzyme sensor, an immune sensor, a nucleic-acid sensor, a microbial sensor, a biosensor, An ion sensor, a chemical sensor, a semi-conductor sensor, an FET sensor, As a gas sensor etc. Various kinds of sensors known the used measurement is possible (it Turner (s) A. — P.P. —) I. Karube and G.S.Wilson, Biosensors - Fundamentals and Applications and 1987, Electrochemical Sensors in Immunological Analysis, 1987; E.A.H.Hall, Biosensors, 1990; R.P.Buck, W.E.Hatfield, M.Umana, E.F.Bowden, and Biosensor Technology- Fundamentals and Applications. Moreover, generally these sensors can carry out the direct method of analysis of various kinds of liquid samples, and its analysis actuation itself is simple. Furthermore, if the liquid sample of the sample tubing 14 interior permeates the analyzor 24 through the introductory tubing 26, the measurement section 68 of the body 12 of equipment mentioned later can sense attainment of a liquid sample through these sensors. Therefore, the measuring device itself can detect the timing of analysis initiation correctly, and a signal output with a high precision according to the device-under-test mass in a liquid sample can be obtained only by an operating personnel equipping a measuring device with the sample tubing 14 and the analysis chip 16.

[0023] It is a measuring method using the specific reaction in which the quality of a device under test participates preferably, and the measuring method using a chemical reaction or a unique ligation reaction is mentioned as a specific reaction. Especially as a chemical reaction, in order to raise singularity and reactivity, the enzyme sensor measurement using biocatalyst molecules and living body functional molecules, such as an enzyme, etc. is mentioned. Although the specific adsorption reaction or specific binding reaction of a measured compound to coordination compounds, such as a functional thin film and a chelating agent, can be used as a unique ligation reaction, in order to raise especially singularity, bonding strength, and versatility, the immunoassay using living body functional molecules, such as an antibody, an acceptor, and a nucleic acid, nucleic-acid hybridization measurement, ligand-receptor measurement, etc. are mentioned, and immunoassay is especially mentioned in respect of versatility etc. as a desirable measuring method. Using the specific reaction of the quality of a device under test, as an approach of detecting the change according to the device-under-test mass by the reaction, in producing electric conductivity change by the reaction, when producing the potential difference for electric conductivity by the reaction and a reaction is an electrochemical reaction accompanied by an electronic transition for the potential difference, the analyzor 24 outputs these electrical signals that what is necessary is just to measure a current etc., respectively. An enzyme and the enzyme electrode which consists of electronic mediators are the desirable examples which can measure with an electrode the enzyme reaction in which the quality of a device under test participates as a current, and much instantiation is also in the above mentioned reference data. Moreover, the approach explained by each specification of JP,5-264552,A by these people, Japanese Patent Application No. No. 338626 [six to], and 7-162297 etc. in full detail as the amperometry approach using a unique ligation reaction is used preferably.

[0024] MEDIA hereafter indicated by JP,5-264552,A etc. -- the analyzor 24 using the electrochemical enzyme immunoassay known as law (Mediator Diffusion-controlled Immunoassay) is illustrated as an example. The outline decomposition perspective view of the analyzor 24 is shown in drawing 3 (a), and the outline side elevation of the analyzor 24 is shown in drawing 3 (b), respectively. Since according to this analyzor 24 blood is used as a liquid sample and the quantum of the amount of estradiols in blood (E2) can be carried out, it is used for an ovarian follicle degree-of-normality diagnosis etc.
[0025] In the analyzor 24 of the example of illustration, the circular cellulose filter paper which the mixed liquor of a hydrogen peroxide and a urea was infiltrated, and was freeze-dried is installed in the lowest layer as the absorption section 32. The circular liquid impermeable seal is stuck in the center of the drawing Nakagami side (let this field as a front face hereafter, and let a reverse side be a rear face) of the absorption section 32 as seal section 32a. On the absorption section 32, the estradiol insolubilization membrane 34 which is circular porosity has doubled and piled up the core.
[0026] The electrode substrate 36 piles up on the estradiol insolubilization membrane 34. The electrode substrate 36 comes to screen-stencil the ring-like silver electrode and ring-like carbon electrode which are formed in a core respectively in accordance with the front face and rear face of a PET film, a ring-like silver electrode (counter electrode 38) is formed in a front face, and the ring-like carbon electrode (operation pole 40) is formed in this rear face, respectively. Furthermore, it flows in a counter electrode 38, counter electrode terminal 38a flows to the operation pole 40, and operation pole terminal 40a is formed, respectively. The ring-like polar zone (38 and 40) and the flow sections other than a terminal (38a and 40a) are covered with resist ink (illustration abbreviation), and are not exposed to a front face. Moreover, the electrode substrate 36 has the through tube 42 which has pierced through the center of two electrodes. In addition, as shown in drawing 1 and drawing 2 , the analysis chip 16 is constituted so that the edge by the side of the terminal of the electrode substrate 36 may project from the body 20 of a chip. The core of a through tube 42 is made in agreement with the core of the estradiol insolubilization membrane 34, and the laminating of the electrode substrate 36 is carried out.
[0027] On the electrode substrate 36, surfactant processing is carried out, and the laminating of the circular glass fiber filter paper 44 which sank in the buffer component and was freeze-dried is carried out so that the core may suit the core of a through tube 42. The circular liquid impermeable seal is stuck in the center of a front face of the glass fiber filter paper 44 as seal section 44a. On the glass fiber filter paper 44, the enzyme labelled antibody sinking-in section 46 which the mixed solution of a par oxidase enzyme-labeling estradiol antibody and an electronic mediator (N, N, N', and N'-tetrakis -(2'-hydroxyethyl)- p-phenylene diamine =THEPD) was infiltrated into the circular glass fiber filter paper, and was freeze-dried piles up a core together with a lower layer. Furthermore, the nonwoven fabric circularly cut on the enzyme labelled antibody sinking-in section 46 may be piled up as the filter section for removing an impurity if needed.
[0028] A liquid sample is introduced into the enzyme labelled antibody sinking-in section 46 from the sample tubing 14 with the introductory tubing 26. In addition, when it has the filter section on the enzyme labelled antibody sinking-in section 46, a liquid sample is introduced into the filter section, and foreign matters, such as an aggregate, are removed here and it is introduced into the enzyme labelled antibody sinking-in section 46. The liquid sample introduced into the enzyme labelled antibody sinking-in section 46 dissolves the enzyme labelled antibody and electronic mediator of the enzyme labelled antibody sinking-in section 46, bypasses seal 44a, and flows the glass fiber filter paper 44 in the direction of a core. The ligation reaction of the estradiol antigen in a liquid sample is carried out to this enzyme labelled antibody, and it forms antigen-enzyme labelled antibody complex in the meantime. Moreover, a corpuscle component etc. is caught within the glass fiber filter paper 44 and the enzyme labelled antibody sinking-in section 46. Further, a liquid sample passes the through tube 42 of the electrode substrate 36, goes into the estradiol insolubilization membrane 34, it bypasses seal section 32a on an inferior surface of tongue, permeates a periphery from a core in the inside of the estradiol insolubilization membrane 34 at a radial, is absorbed into the absorption section 32, and dissolves the enzyme substrate (hydrogen peroxide) of ten daily doses in the absorption section 32.
[0029] The enzyme-labeling structure of the isolation which did not form complex with the antigen estradiol in a liquid sample can form insolubilization estradiol and complex (complex of an insolubilization antigen-labelled antibody), in case a liquid sample permeates a radial in the inside of the estradiol insolubilization membrane 34. Therefore, in the estradiol insolubilization membrane 34, the joint distribution of marker enzyme is formed according to the amount of antigens. That is, the more there are few amounts of antigens in a liquid sample, the more marker enzyme shows the inclination localized to the core of the circular estradiol insolubilization membrane 34. On the contrary, the more there are many amounts of antigens in a liquid sample, the more marker enzyme is scattered all over the estradiol insolubilization membrane 34 whole.

[0030] In the analyzor 24 using this MEDIA method, an electronic mediator carries between the operation pole 40 of the shape of a ring which touched the core of the estradiol insolubilization membrane 34, and the marker enzyme distributed over the estradiol insolubilization membrane 34, and the oxidation reduction reaction of marker enzyme is measured as a current value. In the above-mentioned example, THEPD which is an electronic mediator carries cyclically the reaction to the hydrogen-peroxide substrate of the peroxidase which is marker enzyme, and the electrode reaction in the operation pole 40, and measures the reduction current of the electronic mediator produced on the operation pole 40 according to electrode reaction. Since it is dependent on the mass transfer by diffusion of an electronic mediator, it depends for this reduction current on the distance between an enzyme molecule and the operation pole 40 greatly. So, a current value becomes large, so that there are many marker enzyme molecules which there were few amounts of antigens in a specimen, and they localized to the core of the estradiol insolubilization membrane 34. On the contrary, a current value will become small, if there are many amounts of antigens in a specimen and marker enzyme molecules are scattered in the estradiol insolubilization membrane 34 whole. Therefore, the antigen concentration in a liquid sample can be calculated from the current value which is an electrical signal using the antigen concentration formula determined by analysis of the liquid sample which contains the antigen of standard concentration beforehand.

[0031] Here, although use of an electrochemical reaction was illustrated about the analyzor 24, if it is the approach or the means which the signal according to the device-under-test mass in a specimen can be generated (output), it is available as analytical method of the simple measuring device of this invention as above-mentioned.

[0032] As mentioned above, such an analysis chip 16 can be formed as a macromolecule sheet layered product or its punching articles, such as a PET film. Based on the MEDIA method immunity analysis chip mentioned above, the example is shown in drawing 4 .

[0033] Analysis chip 16A shown in drawing 4 forms the above-mentioned analysis chip 16 and the analysis chip which has this function by carrying out the laminating of the sheet (tabular material) of seven sheets which has the shape of isomorphism mostly by the square system fundamentally in addition to said analyzor 24. As shown in drawing 4 , the square substrate 48 is arranged at the lowest layer of analysis chip 16A, on it, it is of the same shape as a substrate 48, and the laminating of the 1st attachment component 50 by which through tube 50a of the shape of absorption section 32 grade and isomorphism was formed in the center section is carried out. The absorption section 32 and the estradiol insolubilization membrane 34 of the analyzor 24 are inserted in through tube 50a, and are held. On this 1st attachment component 50, the laminating of the above-mentioned electrode substrate 36 is carried out, and the laminating of said 1st attachment component 50 and the 2nd attachment component 52 which has the same configuration is carried out on it. The above-mentioned glass fiber filter paper 44 and the above-mentioned enzyme labelled antibody sinking-in section 46 are inserted in through tube 52a of the 2nd attachment component 52, and the above-mentioned analyzor 24 is constituted.

[0034] On the 2nd attachment component 52, it is almost of the same shape as a substrate 48, and the laminating of the 1st plate-like part material 54 in which heights 54b which has a sharp taper-like tip to the left in drawing (analysis chip path of insertion) was formed is carried out. Moreover, through tube 54a for being open for free passage with the enzyme labelled antibody sinking-in section 46 is formed in that core at this 1st plate-like part material 54. On the 1st plate-like part material 54, the laminating of the introductory plate 56 which has the same appearance configuration as this is carried out, and the laminating of the 1st plate-like part material 54 and the isomorphism-like 2nd plate-like part material 58 is carried out on this introductory plate 56 except not having through tube 54a. Introductory slot 56c which penetrates the introductory plate 56 up and down, and extends from the tip of heights 56b to the location corresponding to through tube 54a of the 1st plate-like part material 54 is formed in the introductory plate 56. That is, in analysis chip 16A of the example of illustration, by inserting the introductory plate 56 by up-and-down plate-like part material, the introductory capillary-like tubing 26 is formed, and a liquid sample flows introductory slot 56c, and is introduced into the analyzor 24 (enzyme labelled antibody sinking-in section 46) from through tube 54a.

[0035] On the 2nd plate-like part material 58, the laminating of the degassing plate 60 of the same appearance configuration as this is carried out, and the laminating of the 2nd plate-like part material 58 and the same 3rd plate-like part material 62 is carried out on the degassing plate 60 except having square punching section 62a in the center. Furthermore, on the 3rd plate-like part material 62, the laminating of the spacer 64 which there is some thickness and has punching section 62a and isomorphism-like space 64a is carried out, the laminating of a substrate 48 and the up isomorphism-like covering 66 is carried out, and analysis chip 16A is formed at the top, i.e., the maximum upper layer of analysis chip 16A. Degassing slot 60c which penetrates the degassing plate 60 up and down to this degassing plate 60, and extends to it from the tip of heights 60b to the location corresponding to said space 64a (punching section 62a) is

formed, further, from the location corresponding to space 64a, 60d of slots opened outside penetrates the degassing plate 60 in the method edge of the right up and down, and they are formed in it. Namely, the degassing tubing 28 is formed by pinching the degassing plate 60 which has slot 60b which results in space 64a in analysis chip 16A of the example of illustration by the 2nd plate-like part material 58 and the 3rd plate-like part material 62. Furthermore, by pinching the 3rd plate-like part material 62 which has the spacer 64 and punching section 62a which have space 64a with the degassing plate 60 and the up covering 66, a bleeder 30 is formed and it opens outside by 60d of slots.

[0036] the ingredient which especially limitation does not have in the ingredient of the tabular material which forms such analysis chip 16A, can secure the rigidity to which the heights which fully form reservation especially the introductory tubing 26, and the degassing tubing 28 for rigidity can punch the lid 19 of the sample tubing 14 easily, and does not affect measurement — various kinds — although it is available, metallic materials, such as various kinds of resin ingredients, such as the above-mentioned PET, and stainless steel, etc. are illustrated, for example.

[0037] Wearing of such both sample tubing 14 and analysis chips 16 on the body 12 of equipment is enabled. In the example of illustration, the above-mentioned sample tubing insertion opening 12a for equipping with the sample tubing 14 is formed in the side face (left-hand side in drawing 1) of the body 12 of equipment, and in order to equip with the analysis chip 16, chip insertion section 12b is formed in the confrontation. Furthermore, the ejection device 74 for discharging the measurement section 68 which measures and processes the electrical signal outputted to this body 12 of equipment from the analysis chip 16, the operation part 70 which calculates the output signal from the measurement section 68, and is made into a measurement result, the display panel 72 which displays a measurement result, and the analysis chip 16 with which the body 12 of equipment was equipped is arranged.

[0038] Sample tubing insertion opening 12a has the almost same diameter as the sample tubing 14, it is a cylinder-like through tube from the left lateral upper part in drawing of the body 12 of equipment to chip insertion section 12b toward a slanting lower part, and sample tubing 14 is made removable on the body 12 of equipment as mentioned above by being inserted and removed from this sample tubing insertion opening 12a. Moreover, when projection 14a is formed in the peripheral face of the sample tubing 14, slot 12c corresponding to this is formed in the internal surface of sample tubing insertion opening 12a, the sample tubing 14 is inserted, and the sample tubing 14 path-of-insertion edge of slot 12c and projection 14a contact, insertion of the sample tubing 14 is regulated, and it is held and is fixed to a predetermined insertion point. In addition, in this invention, the rib and concave which engage with the sample tubing 14 and sample tubing insertion opening 12a mutually are formed if needed. Or when the body 12 of equipment is equipped with the sample tubing 14 by making the sample tubing 14 and sample tubing insertion opening 12a into the size (path) which fits in loosely mutually, it is good also as a configuration which can hold the sample tubing 14 certainly.

[0039] On the other hand, chip insertion section 12b is opening which can insert the analysis chip 16, as shown in drawing 2 , holds the analysis chip 16 in the location which the connection section 22 can insert into the sample tubing 14, and holds this. In addition, it is good also considering wearing of the analysis chip 16 to the body 12 of equipment as a more positive thing by the approach that the approach of forming the projection (the sign y in drawing 1) which engages with chip insertion section 12b and the analysis chip 16 mutually, and a crevice (sign x in drawing 1) if needed etc. is well-known. Moreover, press of other members may constitute Projection y possible [receipt] in chip insertion section 12b Kabeuchi. Here, 12d of slots where the part which projects from the analysis chip 16 of the electrode substrate 36 is inserted in the termination of the analysis chip 16 path of insertion of chip insertion section 12b is formed. That is, counter electrode terminal 38a of the analysis chip 16 and operation pole terminal 40a are inserted in 12d of this slot, and are electrically connected to the measurement section 68 with a well-known means, respectively.

[0040] The equipment of the example of illustration has the ejection device 74 for discharging the analysis chip 16 with which the body 12 (chip insertion section 12b) of equipment was equipped as a desirable mode. There is especially no limitation in the ejection device 74, and all well-known things, such as a mechanical push means using a cam mechanism, a link mechanism, etc., are available in it. Moreover, it is good also as a configuration which discharges the analysis chip 16 by energizing the analysis chip 16 with which the body 12 of equipment was equipped to an eject direction by a spring etc., considering as the configuration which presses this down by hook etc. and equips the body 12 of equipment with the analysis (locking) chip 16, and canceling the lock by this hook etc.

[0041] As mentioned above, counter electrode terminal 38a and operation pole terminal 40a are electrically connected to the measurement section 68 by being inserted in 12d of terminal area fang furrows of the electrode substrate 36 of the analysis chip 16. The measurement section 68 detects insertion into 12d of slots of this electrode substrate terminal area, and is measurable. The measurement section 68 impresses

potential if needed between counter electrode terminal 38a and operation station terminal 74a, measures the electrical signal further outputted from the analysis chip 16 (counter electrode terminal 38a and operation pole terminal 40a), performs required processing of A/D conversion etc., and outputs it to operation part 70. In operation part 70, it has the timer or the counter, after detecting the attainment to the operation pole 40 of a liquid sample, the output signal from the measurement section 68 is calculated after predetermined time, and it considers as a measurement result, and this measurement result is displayed on a display panel 72. In addition, in the simple measuring device 10 of this invention, the measurement result displayed on a display panel 72 may display measured value as it is, may display easy messages, such as a positivity or negative, normal, or abnormalities, and may display the both. Furthermore, you may be the message which gives directions to an operating personnel as shown in the international public presentation number WO 95/No. 16970 specification as these messages, or a command. Moreover, all well-known displays, such as a liquid crystal display and a display using LED as a display panel 72, are available.

[0042] Although the simple measuring device 10 concerning this invention has such a configuration fundamentally, it explains the operation hereafter. In the simple measuring device 10 of the example of illustration, first, as shown in drawing 1 – drawing 2 (b), the sample tubing 14 is inserted in test tube insertion opening 12a, and the body 12 of equipment is equipped with the sample tubing 14. At this time, the inclination is attached to test tube insertion opening 12a as mentioned above so that it may be equipped with the sample tubing 14 with an include angle for a while from a horizontal plane. Thereby, the liquid sample in the sample tubing 14 can be analyzed without futility. Subsequently, as shown in drawing 2 (c), chip insertion section 12b of the body 12 of equipment is inserted and equipped with the analysis chip 16. By this, the connection means 22 (the introductory tubing 26 and degassing tubing 28) penetrates the lid 19 of the sample tubing 14, the interior is reached, and a liquid sample flows into the analyzor 24 from the introductory tubing 26. It is inserted in counter electrode terminal 38a of the analysis chip 16, and 12d of operation pole terminal 40a fang furrows, and connects with coincidence electrically at the measurement section 68. If a liquid sample flows into the analyzor 24, as previously explained with reference to drawing 3 , the electrical signal according to the device-under-test mass in a liquid sample is outputted to the measurement section 68 from counter electrode terminal 38a and operation pole terminal 40a, and a measurement result is outputted to operation part 70, and a measurement result will calculate and it will be outputted to a display panel 72. Thus, if measurement is completed, according to the ejection device 74, the analysis chip 16 will be discharged from the body 12 of equipment, and the sample tubing 14 will be drawn out and removed from the body 12 of equipment. Another inspection is presented with the sample tubing 14, or it is discarded. On the other hand, the analysis chip 16 is discarded. In addition, what is necessary is just to measure by equipping with the analysis chip corresponding to the next measurement, equipping the body 12 of equipment with the sample tubing 14, in performing another analysis continuously to the same sample.

[0043] Various kinds of configurations are possible for the simple measuring device of this invention besides the example of a configuration explained above. The example is illustrated below. In addition, since the example shown below has the same configuration as the above-mentioned simple measuring device 10 fundamentally except that the sample tubing 14 and the wearing approach of the analysis chip 16 differ from the arrangement location of each part material etc., the same sign is given to the same member and the following explanation mainly performs a different part.

[0044] The simple measuring device 76 shown in drawing 5 and drawing 6 has the configuration which equips with the sample tubing 14 from the upper part of the body 78 of equipment, and cylinder-like sample tubing insertion opening 78a penetrates the top face of the body 78 of equipment, therefore it is formed. Moreover, maintenance hole 80a corresponding to sample tubing insertion opening 78a is formed also in the up core of the body 82 of a chip of the analysis chip 80, and the connection means 22 is projected and formed toward the upper part at the core of this maintenance hole 80a.

[0045] In this simple measuring device 76, first, as shown in drawing 5 – drawing 6 (b), chip insertion section 78a of the body 78 of equipment is equipped with the analysis chip 80. Moreover, thereby, the electrode substrate 60 of the analysis chip 80 is inserted in 78d of slots of chip insertion section 78a, and both are connected electrically. Subsequently, as shown in drawing 6 (b) – (c), a lid 19 is carried out caudad, maintenance hole 80a from sample tubing insertion opening 78a is inserted and equipped with the sample tubing 14, thereby, the connection means 22 is inserted into the sample tubing 14, and measurement is performed like the point.

[0046] On the other hand, the simple measuring device 84 shown in drawing 7 and drawing 8 constitutes the body 86 of equipment possible [closing motion] in the shape of a hinge. In the simple measuring device 84 which has this configuration, as first shown in drawing 7 (a) – (b), the sample tubing 14 is fixed to sample tubing insertion opening 86a of the body 86 of equipment. Here, in this mode, the sample tubing 14

is held comparatively firmly at sample tubing insertion opening 86a. Subsequently, as shown in drawing 7 (b) – drawing 8 (c), the protective cap 90 of the analysis chip 88 is removed, the body 86 of equipment is opened wide, the analysis chip 88 is contained to chip insertion section 86c, and subsequently to drawing 8 (d), the body 86 of equipment is blockaded so that it may be shown. Thereby, the connection means 22 is inserted into the sample tubing 14, and measurement is performed like the point. In addition, the analysis chip 88 is set to the example of the book with which it equips from the upper part. Cannot project the electrode substrate 60 from the analysis chip 88, but counter electrode terminal 38a and operation pole terminal 40a have composition exposed to the side face of the analysis chip 88. When the terminal and both-ends child who are stationed at the medial surface of insertion section 86b contact electrically, the measurement section 68, counter electrode terminal 38a, and operation pole terminal 40a are connected electrically.

[0047] Although the simple measuring device concerning this invention explained above is flowing the liquid sample to an analysis chip by capillarity, this invention is not limited to this configuration, but may flow the liquid sample to an analysis chip using means by which the pump etc. was used, such as suction and extrusion, gravity, etc.

[0048] Although use of an electrochemical reaction was illustrated about the analyzor 24 in the above example, if it is the approach or the means which the signal according to the device-under-test mass in a specimen can be generated (output), it is available as analytical method of the simple measuring device of this invention as above-mentioned. The well-known color difference meter with which, as for the measurement section 68 of the body 12 of equipment, a signal consists of a photomultiplier tube, a photodiode, light emitting diode, semiconductor laser, etc. in coloration, fluorescence, luminescence, etc., and a photometer are used.

[0049] As mentioned above, although the simple measuring device of this invention was explained, this invention of various kinds of amelioration and modification being made is natural in the range which limitation is not carried out to this and does not deviate from the summary of this invention.

[0050] For example, it can also make it easy to extend or improve the above-mentioned simple measuring device to the equipment in which the coincidence measurement of two or more specimens is possible. In the simple measuring device for two or more specimens, it has two or more chip insertion sections corresponding to sample insertion opening and it which have the same configuration as the above-mentioned simple measuring device, and can analyze by interlocking independently, respectively. With such equipment for two or more specimen coincidence measurement, by unifying the measurement section, operation part, or a display panel, the configuration of a measuring device may be simplified, the chip insertion section corresponding to two or more sample insertion openings and it may be circularly arranged on a karroo cel, and operability etc. may be raised. Or two or more measuring devices for the above-mentioned unit specimens may consist of external computers controllable. In this case, as long as the throughput of a computer allows, since an operating personnel makes extended connection of the measuring device free according to a measurement situation or a measurement scale, downloads a measurement result to a computer and data processing of it is possible, the efficient clinical laboratory test business of it becomes possible. Anyway, since a liquid sample is automatically introduced into the analyzor, installation of the liquid sample is detected automatically, measurement is started and data processing of the measurement result is automatically carried out when a measuring device is equipped with an analysis chip and sample tubing as the example of the measuring device for unit specimens described, even when it is an object for two or more specimens, it becomes a very highly independent gaging system. That is, if sample tubing insertion opening which has **ed on the measuring device is equipped with sample tubing and it equips with the analysis chip corresponding to the item which should be measured when the specimen which should be measured occurs, a measurement result will be obtained automatically. Therefore, the simple measuring device of this invention pours a liquid sample distributively from sample tubing to a reaction container, and it can provide considering the two or more specimen multi-item random-access function and the interruption measurement which required conventional processing or the procedure of the type which processes and measures a reaction container with reaction Rhine and the migration means which consists of a reagent solution distributive-pouring process, an incubation process, a washing process, a measurement process, etc. complicated at a full automatic analysis apparatus etc. as very easy small equipment.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] (a-I) is the outline top view of an example of the simple measuring device of this invention, and (a-II) is this II-II line outline sectional view.
[Drawing 2] (b) And (c) is an outline sectional view for explaining actuation of the simple measuring device shown in drawing 1 .
[Drawing 3] The outline decomposition perspective view of the analyzor of the simple measuring device with which (a) is shown in drawing 1 , and (b) are the side elevations of this analyzor.
[Drawing 4] It is the outline decomposition perspective view of another example of the analysis chip used for the simple measuring device shown in drawing 1 .
[Drawing 5] (a-I) is the outline top view of another example of the simple measuring device of this invention, and (a-II) is this II-II line outline sectional view.
[Drawing 6] (b) And (c) is an outline sectional view for explaining actuation of the simple measuring device shown in drawing 5 .
[Drawing 7] (a) And (b) is the outline sectional view showing another example of the simple measuring device of this invention.
[Drawing 8] (c) And (d) is an outline sectional view for explaining the actuation of simple ********** shown in drawing 7 .
[Description of Notations]
10, 76, 84 Simple measuring device
12, 78, 86 Body of equipment
12a, 78a, 86a Sample tubing insertion opening
12b, 78b, 86b Chip insertion section
14 Sample Tubing
16, 80, 88 Analysis chip
18 Body of Sample Tubing
19 Lid
20 82 Body of a chip
22 Connection Means
24 Analyzor
26 Introductory Tubing
28 Degassing Tubing
30 Air Hole
32 Absorption Section
34 Estradiol Insolubilization Membrane
36 Electrode Substrate
38 Counter Electrode
40 Operation Pole
42 Through Tube
44 Glass Fiber Filter Paper
46 Enzyme-Labeling Sinking-in Section
48 Substrate
50 1st Attachment Component
52 2nd Attachment Component
54 1st Plate-like Part Material
56 Introductory Plate
58 2nd Plate-like Part Material
60 Degassing Plate

62 3rd Plate-like Part Material
64 Spacer
66 Up Covering
68 Measurement Section
70 Operation Part
72 Display Panel
74 Ejection Device

[Translation done.]

* NOTICES *

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damages caused by the use of this translation.

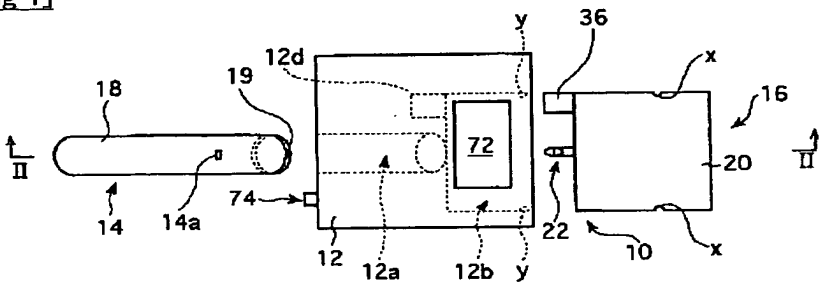
1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

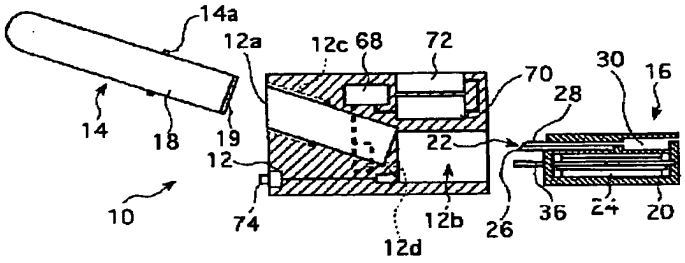
DRAWINGS

[Drawing 1]

(a-I)

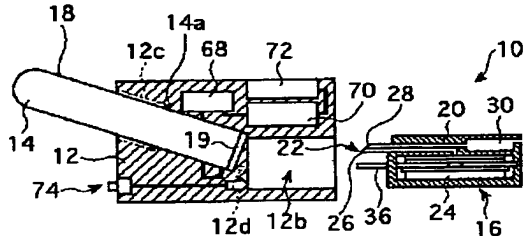


(a-II)

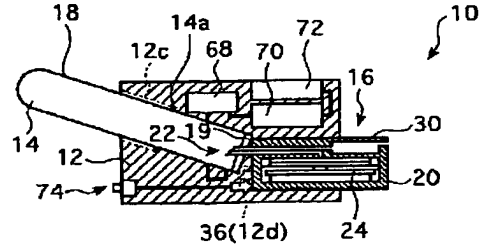


[Drawing 2]

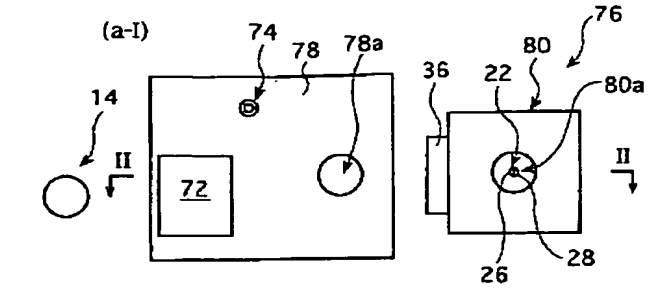
(b)

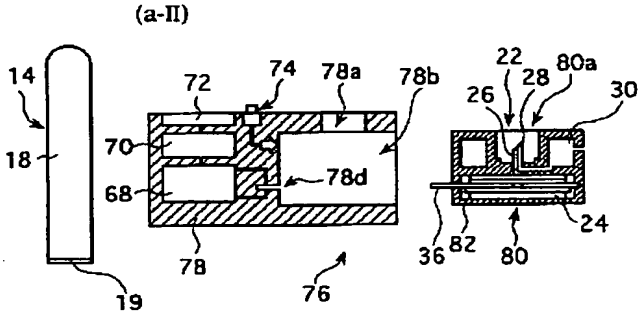


(c)

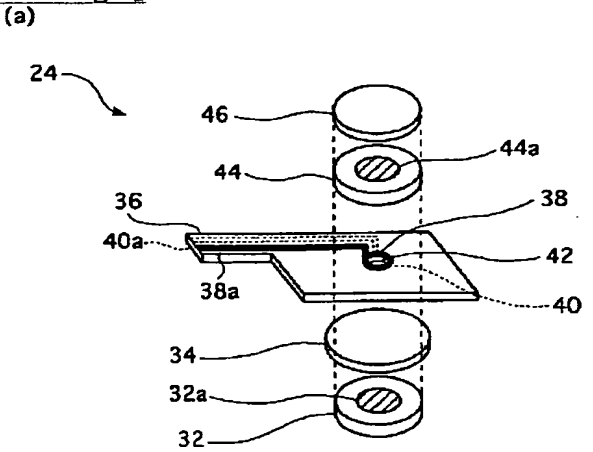


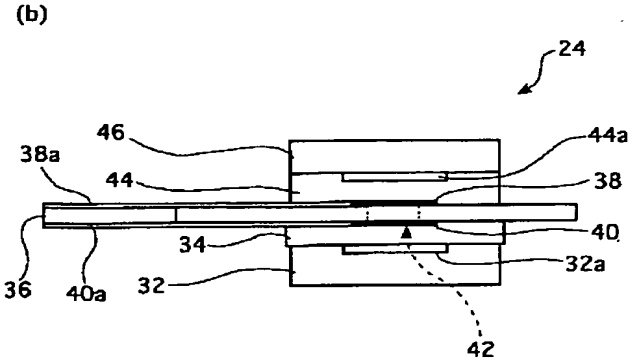
[Drawing 5]



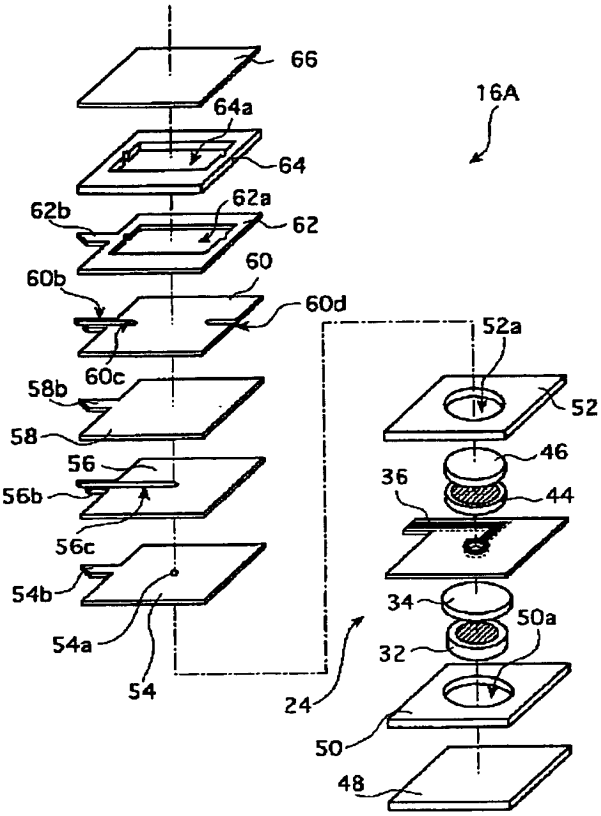


[Drawing 3]

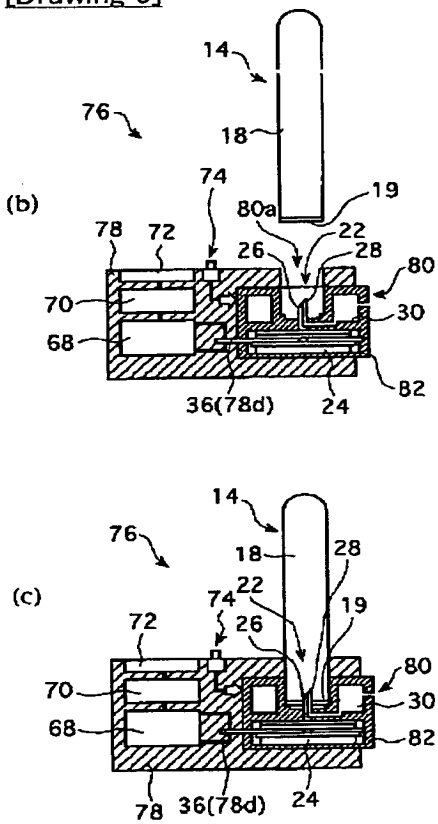




[Drawing 4]



[Drawing 6]



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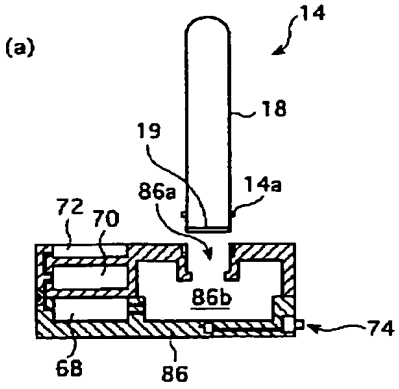
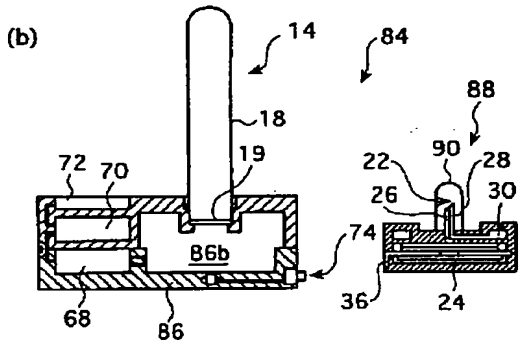
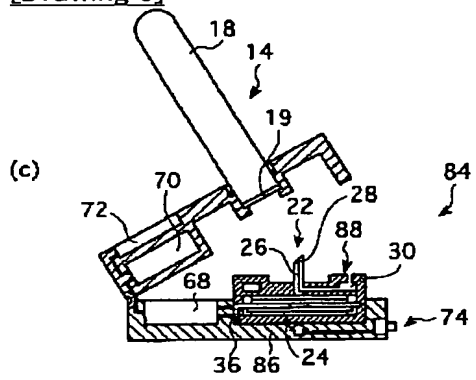
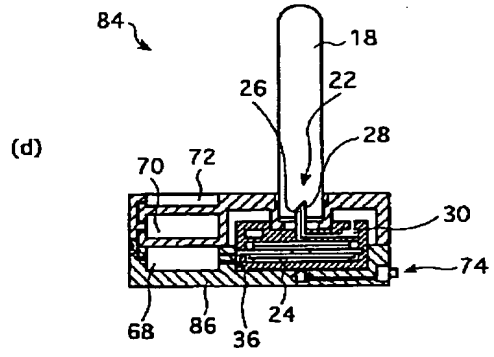




[Drawing 8]





[Translation done.]